Service Service Service Information

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To adapt the Service Manual the following sheets have been changed/added.

Change sheets

1-1-d, 1-2-b
10-1-a÷10-15-d
11-1-b

Supplementary sheets

10-2-1
10-2-2

COMPACT disc DIGITAL AUDIO

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TROUBLESHOOTING GUIDE COMPACT DISC

Preface

In the course of the development of the troubleshooting guide for the Compact Disc it has become clear that a different approach from the one applied so far was required. For, it is no longer possible to use the classic strategy, i.e. basing the troubleshooting method on a number of possible faults in the unit.
Practice has shown that a certain fault, with the associated symptom, can have a wide variety of causes.
The reason is that this player incorporates a number of feedback loop configurations — which, moreover, might affect each other — and this impedes the obvious measurements.

The method below divides the player from diagram point of view into nine clearly distinguishable sub-groups and by performing some measurements, the sub-group being in failure can be isolated. Later the defective circuit can be further examined according to the method given.

PRACTICAL HINTS

Test discs

It is important to handle the test discs with great care.
For, the troubles (black dots, fingerprints, etc.) are exclusive and unambiguously positioned.
Damage can cause additional drop-outs etc. and as a result the conscious fault on this disc is no longer exclusive.
In that case it is no longer possible to check e.g. whether the track detector is working correctly.

Measurements on op-amps

In the electronic circuits of the servo systems op-amps are frequently being applied. These op-amps can be used as amplifiers, as filters, as invertors, as buffers, etc.

In those cases where feedback is applied in one way or the other, the voltage difference at the differential inputs inclines to zero. This applies both to DC and to AC.
The cause can be traced back to the properties of an ideal op-amp ($Z_i = \infty$; $G = \infty$; $Z_o = 0$).
In practice this means that it is nearly impossible to perform measurements on the inverting and non-inverting inputs of op-amps if one input is directly connected to ground.
In those cases only the output signal will be measurable.

That is why in most cases no AC voltages can be given to the inputs.
The DC voltages at the inputs are equal.

Stimulating with „0" and „1"

In the troubleshooting method certain pins should in a number of cases be connected to ground or be connected to the power supply voltage.
This way of acting offers the possibility to overrule certain circuits and to stimulate others.
In this way the diagnose time can be reduced.

In a number of cases the relevant pins appear to be **op-amp outputs.**
In this respect it should be mentioned that the outputs of the used op-amps are short-circuit protected.
This implies that the output of an op-amp can be made low (= usually ground potential) without consequences.
On the other hand should be pointed out that it is **not allowed** to connect the **output** of an op-amp directly to the **power supply voltage.**

I/0s of microprocessors should not be connected directly to power supply voltage.
These I/0s are allowed to be brought to „0" in case this is mentioned explicitly.

Selection of ground point

It is very important to select a ground point as close as possible to the test point.

Conditions for injecting

— It should be pointed out that injection of levels or signals from a strange source is **never** allowed to occur when the power supply voltage is lacking in the circuit in question.
— Naturally, the injected level is never allowed to exceed the power supply voltage of the circuit in question.

Continuous burning of the laser

If plug A17 is disconnected and the cover switch is bridged, the laser will start burning continuously during power-on.
At the same time the focus loop and the radial loop are interrupted on pins A171 (FE = Focus Error), A174 (RE1 = Radial Error 1) and A173 (RE2 = Radial Error 2) respectively.
The laser is giving light for an unlimited period of time in service loop A, also without a disc on the turntable.

Irregular working of the display

Irregular working of the display when the set is opened and playing, might have been caused by incidental body effect in the region of the crystal oscillators.
Switching „off" and „on" of the mains voltage will eliminate this effect.

Indication of checkpoint

In the circuit diagram and PCB diagrams the checkpoints have been given a serial number (e.g. 12), to which the troubleshooting method will refer.
For oscillograms, amplitudes, time bases and position of set, see tables of checkpoints.

GENERAL CHECKPOINTS

In the detailed troubleshooting method following below a number of general conditions, required for proper functioning of the player, will **not** be repeated.
Before starting the detailed troubleshooting method these general points should be checked.

a. Ensure that the cover is closed or the cover switch is bridged during measurements.
b. Ensure that disc and objective are clean (remove dust, fingerprints, etc.) and use undamaged discs.
c. Convince yourself of the presence of the clock frequencies, viz.:
   - 4,433619 MHz for oscillator frequency μP decoding
   - 6 MHz for μP servo
   - 4,233600 MHz for CIM-IC
   - 4,32 MHz for free-running PLL circuit on the DEMOD IC.
d. Check whether all power supply voltages are present and have the correct level.
e. Check whether the two mutes (KILL and $\overline{\text{SMSE}}$) are inactive so that data are nowhere interrupted.
f. Check good working of both microprocessors by means of their built-in self-check program and possible periferal check program.

Method:

Self-check decoding μP 6654

— Take servo μP 6201 out of its socket.
— Connect on the decoding μP pins 18 and 21 with pin 14.
— Interconnect pins 6 and 14, at the same time switch on mains voltage, then disconnect pins 6 and 14.
— Inspecting the working of the μP means checking whether pin 22 of the μP goes within 1 s. from „1" to „0".

Self-check servo μP 6201

— Take decoding μP 6654 out of its socket.
— Connect on the servo μP pins 18 and 21 with pin 14.
— Interconnect pins 6 and 14 at the same time, switch on the mains voltage, then disconnect pins 6 and 14.
— Inspecting the working of the μP means checking whether pin 22 of the μP goes within 1 s. from „1" to „0".

Periferal check servo μP 6201

1. Place disc on turntable and switch off mains voltage.
   Keep the Stop button depressed while the mains voltage is switched on.
   Release the Stop button after 1s.
   Now the player is in the so-called SERVICE LOOP A.
   This means that the laser is working, the focusing control is working and the turntable motor is running while the light pin settles itself against the inner stop (i.e. constantly remains in the lead-in tracks).
   The radial servo system is switched off.
   In this service loop all LEDs and control buttons can be checked simultaneously as follows:
   — Initially all program LEDs should light up and go out one by one from left to right in a rhythm of one per second. If LED 15 is extinguished, the proces is repeated.
   In the track bar only the LED corresponding with the lowest program LED will light up.
   — If one of the buttons Pause, Select, Store, Cancel, Repeat and Reverse is depressed, the LEDs „Pause" and „Repeat" will go from on to off (or vice versa). The Error LED will also light up. It will go out again if the track LED steps.
2. The player can be brought in service loop B (assumed the set is in service loop A) by keeping the Search Forward button depressed until a whistle is heard.
   Now the radial servo system is switched on, independent of the conditions of P bit and subcode (via the bus).
   The display remains in the service routine.
3. After the Play button is depressed (assumed the set is in service loop A or B), the player will leave the service loop and reassume the user-preferred position.

g. Eye pattern
   Check on the oscilloscope whether the H.F.-signal — called eye pattern — has the correct value.
   Set for this purpose the time basis of the oscilloscope to 0,5 μs and check test point 65 (= output pre-amplifier).
   This picture is fairly stable if PLL circuit is in lock and turntable loop is controlling correctly.
   A vibrating or **unstable eye pattern** can be caused by a poor turntable motor, or by bringing the set in **service loop A.**

DETAILED TROUBLESHOOTING METHOD

A number of quick and efficient checks immediately give a definite answer on poorly functioning sections of the player.
To check the servo systems two service loops have been built in μP 6201.
Before calling in service loop A or service loop B, it should be checked (position power on) whether the bus (clock, data; pin 3 and 2 of μP 6201 resp.) is free. In other words, checking whether these lines do not have a short circuit to ground or supply voltage (level low or „high"). In such a case the buttons cannot be operated.

For troubleshooting the step-by-step method below is followed.

First step (with disc on turntable)
Bring the player in service loop A. (Method: keep Stop button depressed while mains voltage is switched on). In this situation the laser, the focus control and the turntable control have to work. The light pen should always be against the innermost stop, i.e. the light spot continuously stands on the lead-in grooves.
If one of these conditions is not met, the questions below should be answered positively **in the sequence given.**

In practice this means that when one question has been answered positively, all the preceding circuits, to which the questions refer, are functioning well.

Example: if the eye pattern is present, we may conclude that the laser is working, the laser is in focus and that the turntable motor is running.

Note:
In some situations, certain faults in the radial servo circuit affect the focus servo circuit (e.g. If supply voltage +1 of IC6214 in the radial circuit fails, the focus coil starts oscillating).
To determine if this situation exists, connect point 36 to ground.
In this way, the influence of the radial servo circuit on the focus servo circuit can be eliminated.

A. Is the laser giving light?
   (Test method: see sub A).

B. Is the angle disc-light pin within the tolerance, i.e. 90° ± 0,5°?
   (Test method: see description mentioned in chapter 6).

C. Is the laser giving sufficient light?
   (Test method: see sub C).

D. Does the objective come in focus?
   (Test method: see sub D).

E. Is the turntable motor running and, if so, is it running at the correct speed?
   (Test method: see sub E).

If the answers to questions A through E are positive, it should be possible to bring the player in service loop A.

Second step (with disc on turntable)

Bring the player in service loop B.
Procedure: starting from service loop A the Fast Forward button should be kept depressed until a whistle is heard.
Now the radial servo system is switched on but μP 6201 ignores the activity on P line (P bit) or bus (clock, data for subcode).
Tracking of the first song is executed immediately when the spot is brought above the tracks by hand.

This means that the eye pattern on point 65 has to be stable, while MCES on point 17 has to be more stable too.

Note:

that the set is **not only tracking** asong in loop B, **but also playing** the song, provided the digital circuit is working.

If this does not work, return to service loop A and answer the question below positively in the sequence given.

F Are $\overline{\text{DO}}$ and HFL detectors functioning?
   (test method: see sub F)

G. Is track detector functioning well?
(test method: see sub G)

H. Is the radial control functioning properly?
(test method: see sub H)

If the answers to questions F, G and H are positive, it should be possible to bring the player in service loop B.

Third step (with disc on turntable)

Select the Play mode.
After a brief whistle the display will give the number of tracks present on the disc. Then tracking of the first song is executed while P bit and bus (clock, data for subcode) are also taken into account bij μP 6201.
Note that the set is not only tracking a song in loop B, but also playing the song, provided the digital circuit is working.

If this does not work, return to service loop B and answer the question below positively.

I. Is the P-bit functioning?
(test method: see sub I)

J. Is information transmission subcode functioning?
(test method: see sub J)

K. Is T1 functioning, i.e. polarity of RE?
(test method: see sub K)

If the answers to questions I, J and K are positive, it should be possible to bring the player in the Play mode.

Fourth step (with disc on turntable)

If no music is heard in position „play" answer the last question.

L. Is digital decoder circuit functioning according to specification (test method: see sub L).

Sub. A. IS THE LASER GIVING LIGHT?

Test method

Bring the player in service loop A without placing a disc on the turntable. Now the laser is giving light for an unlimited period of time.

Another method for which the laser gives light during an unlimited period of time and the objective is **standing still,** is disconnecting plug A17 and bridging the cover switch. In case of power-on the laser should burn. This is checked with the aid of a light-sensitive component which is slightly screened from daylight.

Hereafter follow some examples:

a. Connect photosensitive diode type BPW34, code number 4822 130 32108, with correct polarity to an **analogue** multimeter (e.g. PM2412) at range 10 kΩ.
If the laser is burning, the meter will give virtually full scale deflection.

b. Connect LDR, code number 4822 116 10002, to digital multimeter PM2517E.
If the laser is burning, the resistance will drop to approx 8 kΩ.

If the laser is **not** giving any light, proceed to Annex I.

Sub. C. IS THE LASER GIVING SUFFICIENT LIGHT?

Test method (Test points on Pre-amp PCB, circuit diagram E and servo PCB circuit diagram C).

— Interrupt the collector of TS6230 or render pin 18 of μP servo „low".
— Disconnect plug A17: Now the laser is burning continuously while FE, RE_1 and RE_2 are interrupted.
— Place disc on turntable and switch power on.
— Directly inject with AF generator ($Z_i \leqslant 600$ Ohms) to test point 1 a sine-wave signal between 25 and 60 Hz (exact frequency is player-dependent) and 2 V_{pp}.
— Select such a frequency that the monitor diodes of the light pin give output signals as indicated on test points 5, 6, 7 and 8. Amplitude 40 - 80 mV.
— If the amplitude is not sufficient, proceed to Annex I.

Sub. D. IS THE OBJECTIVE COMING INTO FOCUS?

Test method:

● **No disc on turntable**

Switch power on and actuate Play button.
Now the arm should move inwards. Immediately after that the objective should move four times (two times of μP 8440 is used) up-and downwards (this happens during searching of the focusing point).
After this the action will stop.
These actions are software-controlled from the servo μP.
If this is not working, check μP servo, end stage focus circuit or focus coil.

● **With disc on turntable**

Quick test procedure:

For a rough check on the working of the focus circuit, proceed as follows:
— place disc on turntable.
— set player in service loop A.
— remove disc from turntable.
— now examinate of the objective focuses by bringing a reflective object (e.g. mirror) above it.

Detailed test procedure

— Check TS6230 (on servo PCB, circuit diagram C) as follows:
Check whether FN becomes with each passage of the nominal focusing **low for a short period of time**. Only when focusing point FN has been found, FE will be released via TS6230 (base will become negative).
Check whether base of TS6230 is driven low from servo μP (= FCO). If not, check servo μP.
If so, proceed.
— Test focusing circuit as follows:
Interrupt the collector of TS6230 (or render pin 18 of μP servo „low"), disconnect plug A17 and switch power on.
Now the laser is burning continuously, FE has been released and the focus loop has been interrupted at test point 1 (= FE) on servo PCB, circuit diagram C.

Testing of circuit, between test point 1 and focusing coil (Test points on servo PCB, circuit diagram C).

— Directly inject a sine-wave signal of 10 Hz, $2V_{pp}$, to test point 1 by means of an AF generator ($Z_i \leqslant 600\ \Omega$).
— Check visually whether focusing coil — and thus objective too — responds.
— Check whether this voltage is 1 V_{pp} on test point 2.
— Check whether this voltage is 9 V_{pp} on test point 3.
— Check whether this voltage is 8 V_{pp} on test point 4.

Testing the subchassis: (Test points on Pre Amp PCB, circuit diagram E and servo PCB, circuit diagram C).

— Directly inject to test point 1 a sine-wave signal between 25 and 60 Hz at 2 V_{pp} by means of an AF generator ($Z_i \leqslant 600\ \Omega$) (the exact frequency is player-dependent).
— Select such a frequency that the monitor diodes of the light pin give output signals as indicated on test points 5, 6, 7 and 8.
— Check test points 9, 10, 11 and 12.
— Check test point 13.
— Check test point 14.
Is the same as signal on test point 13 but amplitude is dependent on position of potentiometer R3158.

If all the checks are positive, close focus loop (insert plug A17). Now the focusing circuit should be able to operate. It should be noted here that the amplitudes on test points 5 through 13 are slightly dependent on the characteristic of the monitor diodes.

Sub. E. IS TURNTABLE MOTOR RUNNING AND, IF SO, IS IT RUNNING AT THE CORRECT SPEED?

Test method: (Test points on servo PCB, circuit diagram C)

a) Place disc on turntable and bring set in service loop A
b) If focussing point is found, check whether FCO is low on point 15.
If not, check focus circuit sub D.
If so, proceed.
c) Disconnect plug A66 (on decoding PCB).
Also disconnect plug A14 (on preamp-PCB) and inject 2.5 V DC to the socket of plug A14 (= turntable motor). The turntable motor should be running now.
(A DC voltage of 2.5 V approximately corresponds with the r.p.m. during scanning of the innermost tracks).
In this condition the player should be brought in service loop A (depress Stop button while mains voltage is switched on).
If DC $<$ 2.5 V, check test point 91 fig. XX (on decoding diagram).
IF DC $>$ 2.5 V, no measurable signal is present on testpoint 91.
If this is working, proceed to d).
If this is not working, proceed to f).
d) Connect again plug A66 (while plug A14 is still disconnected, a DC voltage is injected to the socket of plug A14, and the player is brought in service loop A).
If DC$<$2.5 V, Figure GG should be visible on testpoint 17.
If DC$>$2.5 V, Figure HH should be visible on testpoint 17.
The same phenomena should be measured on testpoint 91 (on decoding PCB).
If so, check turntable control circuit (circuit from point 17 to turntable motor).
If not, check whether MCES is released by means of FCO at the output of IC6205D.
This can be done by disconnecting MCES from point 1 of IC6205D.
(Interrupt jumper on point 1 of IC6205D on servo PCB).
If MCES is working now, check circuit around IC6205D.
If not, proceed.
e) If MCES is still not functioning properly, reconnect jumper (on point 1 of IC6205D) and proceed as follows:
f) - Check whether point 55 (= HFI) is correct in service loop A (see Figure Y), while turntable motor is still running via injected 2.5 V DC.
If so, proceed.
- Take player out of service loop A, depress Power-on button and then play button and check eye pattern on point 65.
To stabilize the eye pattern, bring light pin above tracks by hand, or by briefly (5 sec) depressing Fast Forward button.
If eye pattern on point 65 is not present or unstable, check RF pre-amplifier (see Annex V).
If eye pattern is correct, proceed.
- Check locking-in of PLL circuit of DEMOD-IC. See Annex II: Checking locking-in of PLL circuit.
If PLL is locking-in, proceed.
- Check timing signals and their interrelations on testpoints 80, 89, 90, 91.

Sub. F. ARE THE $\overline{DO}$ AND HFL DETECTORS FUNCTIONING?

Test method (Test points on servo PCB, circuit diagram C)

— Starting point is:

HFL	=	1 when spot is exactly on track
$\overline{HFL}$	=	0 between tracks (e.g. during track jumping)
$\overline{DO}$	=	0, or DO = 1 in case of drop-out
$\overline{DO}$	=	1, or DO = 0 when there is no drop-out.

Approximative method
(applicable in service loop A)

— Place disc on turntable.
— Bring player in service loop A.
— Check whether DO (test point 57) is not continuously „high". Normally test point 57 is „low"; however small spikes of approximately 100mV are present in case of scratches on the disc.
— Check HFL (test point 55, Fig. Y).

Precise method
(can be checked in playing set only)

— Place test sample 4A (4822 397 30086) on turntable. Switch power on and depress Play button.
— Select track no. 10: Check point 55.
HFI pulses should be present.
— Select track no. 15: Check point 56.
$\overline{DO}$ pulses should be present. With this track the HFI pulses on point 55 should also be present.
— In case of track jumping HFI pulses are always present on point 55.

Sub. G. IS TRACK DETECTOR FUNCTIONING WELL?

Test method: (Test points on servo PCB, circuit diagram C)

— Insert disc, set player to service loop A and if a potentiometer R3315 is used connect point 20 to ground. If for R3315 a fixed resistor is used. Connect than a resistor of 330K between point 32 and 33 and connect than point 20 to ground.
— Measure F.S. on point 36.
Here too the frequency variation depends on the eccentricity of the disc.
— Check point 60.

— Check point 61. Signal cannot be triggered.
If R3363 is interrupted no signal is allowed to be present on point 61.

— Check points 62 and 63.

Sub. H. IS THE RADIAL CONTROL FUNCTIONING PROPERLY?

Attention: The offset circuit (d-multiplier) and the AGC circuit (k-multiplier) are correction circuits. This means that under optimal conditions (new disc minimum tolerances of components). The set may be working properly even if a fault is present in offset or AGC circuit.

Test method: (testpoints on servo PCB, circuit diagram D)

a. Place disc on turntable.
b. Switch off AGC circuit (k-multiplier) and switch off offset circuit (d-multiplier).

Method:
Switching off AGC circuit: intercoonect points 5 and 6 of IC 6216, or interconnect resistors. R3293 and R3294.

Switching off offsetcircuit:
- If potentiometer A3315 is built in: connect point 20 to ground.
- If a fixed resistor is built in:
  connect point 20 to ground and connect a resistor of 330K between points 32 and 33.

Proceed.

c. Bring set in service loop B.
At this moment there is a high probability that the set is working.
If so, check b and d factor (see Annexes IV and III)
If not, proceed:

d. Bring set in service loop A and check signal on point 21.
The AC-component has to be 12-14 V symmetrically, around a DC level of zero volt.
If this is correct, proceed to e).
If this is not correct check following testpoints
22, 23 : value should be 0,7 V_{pp}
24 : value should be 0,2 V_{pp}
25 : value should be 0,25 V_{pp}
26 : value should be 20 mV_{pp}
27, 28 : value should be 800 mV_{pp}

Note:
The frequency variation strongly depends on the eccentricity of the disc.
If points 22 ÷ 28 are OK, check point 21 again.
If 21 is OK, proceed.

e. Check point 29 (is RE +650 Hz).
Value should be 6 V_{pp}. If so, proceed (in position power-on only, 650 Hz at 300 mV is present on point 29).

f. Point 67 is hard to measure. However a signal of low level is present.
If so, proceed.

g. To check radial output stage, do not use a disc, only power on. Inject on points 30 and 31 respectively a sine-wave signal of 8 to 10 Hz 3 V_{pp}.
Then the radial motor will go back and forth.

At this moment radial tracking must be possible in loop B.
Disconnect R3293 and R3294.
If the orginal fault sympton is still present, see Annex IV: Checking K-factor.

Disconnect point 20 from ground and, if necessary, remove resistor between points 32 and 33.

If the original fault sympton is still present see annex III: checking d-factor.

Sub. I. IS THE P-BIT FUNCTIONING (servo PCB, circuit diagram C)

Test method:

Bring the player in service loop B.
After approx 45s, just before the music starts to play, the P-bit (pin 5 of the servo μP) should briefly (approx 2s) be „high".
This can be measured on an oscilloscope in the position DC and 2V per division.

Sub. J. IS INFORMATION TRANSMISSION SUBCODE FUNCTIONING? (decoding PCB circuit diagram F)

Test method:

Bring player in service loop B.
Check whether there is **activity present** on the bus (pins 2 and 3 of μP servo).
Depress the Play button and check whether the activity „increases" on pins 2 and 3 of μP servo.
If not, check test points 72, 73, 74, 75, 95 and 96 and their interrelations (trigger oscilloscope at point 72).

Sub. K. IS T1 FUNCTIONING, I.E. POLARITY OF RE? (servo PCB, circuit diagram C)

Test method:

Bring player in service loop B and measure T1 on pin 13 of μP servo.
A square-wave voltage (0-5V) should be measured on this pin. As a result of the frequency variation this square wave is hard to trigger.

Sub. L. IS THE DIGITAL DECODER CIRCUIT FUNCTIONING ACCORDING TO SPECIFICATION?

Test method:
Test points on decoding PCB, circuit diagrams F and G)

— First condition is that the main motor is running at the correct speed. This implies that the PLL circuit is functioning properly. If not, apply test method sub E).
— Second condition is that the RF pre-amplifier is functioning properly. See for this purpose Annex V — Test method RF preamplifier.
— Servicing of the digital decoder circuit in principle requires special test equipment, in particular to measure data outputs. For practical reasons Service supplies 2 IC sets consisting of the specific digital ICs. Code number 4822 395 30194 and 4822 397 60069. With the aid of this set of ICs a possibly defective IC can be isolated through the method of trial and error.
— Appart from the data outputs, which can in priciple not be measured when the unit is playing, a number of communication lines, responsible for timing, can be measured. In this way it is also possible to isolate faults in the „periphery" of the specific digital ICs. These signals can be verified with a normal oscilloscope.
To data outputs the following applies:
— In a playing unit it is only possible to check whether data are **present** or not.
— In a non-playing unit measurements **can** be performed in a number of cases. See the Tables for this purpose.

Measurements

DEMOD

For mode of player (Play, Stop) see Table (circuit diagram F).
— Check clock on test point 71. Is also present in case of power on, Stop mode. Test point 71 synchronises when PLL is locking in. To check locking-in see Annex II.
— Check test point 72.
— Check test point 88.

INTERFACE

For mode of player (Play, Stop), see Table.

a) MCES (circuit diagram F)
- Check test points 80, 89, 90 and 91 and their interrelations.
- If the MCES is not good, see sub E).

b) Main oscillator + derived frequencies (circuit diagram F)
Check test points 92, 93, 94, 96 and 97 and their interrelations.

c) LRCK (Circuit diagram F)
Check test points 95, 98, 99, 100, 101, 102, 78 and 103 and their interrelations.
These measurements can be performed both with open and with closed loop.
This only affects test point 103. See the oscillograms for this purpose.
The loop can be interrupted by disconnecting R3708.

d) Crystal oscillator (circuit diagram F and G)
Check test point 77 by means of oscilloscope and counter.

e) $\overline{\text{PEPS}}$ (circuit diagram F and G)
Check test points 97, 99, 79, 91 and 92 and their interrelations.

f) CPPS (circuit diagram F and G)
Check test points 96, 99, 104 and 81 and their interrelations.

g) STR1 (circuit diagram F and G)
Check test points 93, 99, 105 and 106 and their interrelations.

h) STR2 (circuit diagram H)
Check test points 93, 107 and 108 and their interrelations.

ERCO CONTROLLER (circuit diagram G)
Timing
— Check test points 83, 84 and 85 and their interrelations.
— Check test points 86 and 87
Here the oscilloscope is triggered with test point 80.

DATA

The remaining communication lines cannot be measured with standard test equipment. (e.g. points 72, 76, 82).

FIL

For mode of player (Play, Stop) see Table. (Circuit diagram H)
— Check point 93.
— Check test point 106.
If this is good, trigger oscilloscope with point 106 (= STR1).
— Measure points 109, 110 and 111 and their interrelations.
— Measure points 93, 107 and 108 and their interrelations.

DAC (circuit diagram H)

In the Play mode the analogue (music) signal is present on the outputs of opamps 6673 (left) and on the outputs of opamps 6675.
If necessary, check KILL relay.

Annex I: LASER IS GIVING NO OR INSUFFICIENT LIGHT

Together with the laser supply and the monitor diode the laser forms a feedback system.

A defect in the laser supply might thus result in destruction of the laser. Replacement of the laser (= new light pin) will not solve anything. The new laser will also be destroyed since the original fault in the laser supply is still present.

On the other hand it is impossible to check and repair a feedback system when one link is missing.

For this reason the so-called laser simulator is supplied. Code number 4822 395 30203 for lasers with negative supply voltage and 4822 395 30215 for lasers with positive supply voltage. This laser simulator consists of a PCB which contains the laser and monitor simulation, a switch to test the On/Off position and a number of sockets.

This PCB can be connected to the laser supply instead of the light pin so that the feedback system is closed.

Repair procedure:

Detach light pin and connect laser simulator as follows: (connections on pre-amp PCB).

Since the light pin is very sensitive to static charges, care should be taken that during measurements and adjustments of the laser power supply the potentials of the alds and yourself equal the potential of the CD mechanism.

Take the flex PCB out of socket A11 and connect the simulator PCB with the socket.
Remove plug A16 and insert it in the socket on the simulator PCB.
Connect the plug with 4 wires to socket A16. Take out plug A17 and insert the plug with 1 wire in socket A17.

— bridgecover switch.
— switch power on, depres play button and check whether L line from servo μP becomes low.
— In rest position the current through the laser diode should be $\leqslant$ 1 mA. For NEGAT VOLT. lasers this van be checked as follows:
Set the switch on the simulator PCB in the OFF position and the mains switch in the ON postion.
Turn trimming resistor 3180 counterclockwise (min. R) and measure the voltage across resistor 3194.
The voltage should be $\leqslant$ 10 mV.
Check of laser supply control (NEG. VOLT PH):
Set the switch on the simulator PCB in the ON position and measure the voltages between points V and $\perp$ on the simulator PCB.
Resistor 3180 clockwise (max. R): Uv$\perp$ = —120 mV ±24 mV.
R3180 counterclockwise (min. R): Uv$\perp$ = —720 mV ±144 mV.
Adjust resistor 3180 so that Uv$\perp$ is approx. —500 mV.
This is a preliminary adjustment. After the simulator PCB has been removed the laser current must be adjusted.
— Fine adjustment of laser current.
Playback track 1 of test disc 4822 397 30086 (Disc without defects). Connect a DC voltmeter across resistor 3308 on the SERVO PCB circuit diagram D. Adjust the laser power supply with resistor 3180 until the voltage acorss resistor 3308 is 500 mV±50 mV.

Attention

Too high a laser current (> 500 mV across resistor 3308) will reduce the life of the laser diode.

Remark:

It is recommended to use the laser simulator for any measurement in the laser supply, since incidental short-circuits with the test pin can have inconvenient consequences for the laser.

For POSITIVE VOLT. lasers this can be checked as follows:
Set the switch on the simulator PCB in the OFF position and the mains switch in the ON position.
Turn trimming resistor 3180 counterclockwise (min. R) and measure the voltage across resistor 3194.
The voltage should be $\leqslant$ 15 mV.

Check of laser supply control:
Set the switch on the simulator PCB in the ON position and measure the voltages between points +V and —V on the simulator PCB.
Resistor 3180 clockwise (max. R): U+v -v = 60 mV ±30 mV.
R3180 counterclockwise (min. R): U+v -v = 560 mV ± 50 mV.
Set resistor 3180 in the mid-position.
This is a preliminary adjustment. After the simulator PCB has been removed the laser current must be adjusted.

Annex II: CHECKING LOCKING- IN OF PLL CIRCUIT (Test points ar decoding PCB circuit diagram F)

First the free-running oscillator should be checked and adjusted as follows:

(See decoder PCB)
Select the stop mode.
Connect a frequency counter between pin 22 of IC6501 (DEMOD) and $\perp$.
Adjust coil 5501 for a frequency of 4.350 MHz ± 5 kHz.

Attention

This adjustment should be performed immediately after the unit is switched on.

Checking locking-in:

— Insert disc, disconnect plug A14, inject 2,5 V_{dc} to the socket of plug A14 on pre-amp PCB, circuit diagram E and set player in service loop B.
— Variation of the DC round 2,5 V should be visible on the oscilloscope (point 1) in the form of a frequency variation. This means that the PLL is locking in.

Annex III: CHECKING d-FACTOR (Test points on servo PCB, circuit diagram D)

Connect point 20 to ground.

(If a fixed resistor is built in, instead of potentiometer R3315, it will also be necessary to connect a resistor of 330K between points 32 and 33.)

Place disc on turntable and set player in service loop A.

— Check points 23 and 22.
Value should be 0,7 V_{pp}.
Frequency variation strongly depends on the eccentricity of the disc.
— Check point 25.
Value should be 250 mV_{pp}.
— Check point 35.
Value should be 200 mV_{pp}.
— Check point 36.
Value should be 2 V_{pp}.
— Check points 37 and 38.
Value should be 10 V_{pp}.
The signal is more sine-shaped now due to filtering out of 650 Hz.
— Point 39 is hard to measure since switch is in position Y_{oc} and thus connected with input of op-amp 6215.
However, a signal of 200 mV_{pp} is present.
— Check point 40.
Value should be 9 V_{pp}.

Bring the player in service loop B with disc on turntable while point 20 is still connected to ground. (and if necessary, while a resistor of 330K is connected between points 32 and 33.)

— Check point 41.
— Check point 40 on beam A of oscilloscope and check point 39 on beam B of oscilloscope while oscilloscope is triggered with point 41.
— Disconnect point 20 from ground, go to service loop A and check whether point 20 can be adjusted to zero volt. By means of R3315.
(In case of fixed resistor is built in, in stead of R3315, disconnect point 20 from ground, remove the resistor of 330K between points 32 and 33, go to loop A and check if the voltage on point 20 is between —5 V and +5V).

Annex IV: CHECKING k-FACTOR (Test points on Servo PCB, circuit diagram D)

a. Static

Switch power on **without** depressing the Play button.
I.e. RC0 = high; $\overline{RC0}$ = low so switch Y_b is in position 0 and switch Y_c is in position 0.

— Check point 45.
Value should be 9 V_{pp}.
— Check point 46.
— On point 29 now appears a sine-wave signal of 650 Hz, 300 mV, and 180 - 45 = 135° shifted in phase relative to signal on point 45.
— Check point 47.
Value should be 1,5 V_{pp}.
— Check point 48.
Value should be 1 V_{pp}.
— Check points 49, 50, 51 and 46 relative to each other.
Amplitudes are 5V.
— Check integrator IC 6212A.

b. dynamic

Insert disc, select service loop A and check if the signal on point 21 equals to 7 V_{pp}.

— Select service loop B.
Now $\overline{RC0}$ = high and RC0 = low.
So switch Y_b is in position 1.
Switch Y_c switches at f = 650 Hz.
point 52 is low; so point 51 is in phase with point 50.
Now Fig. U should be present on point 51 with duty cycle jittering round 50%.

Annex V: CHECKING RF PRE-AMPLIFIER (circuit diagram E)

a. Check DC-voltages on transitors 6103, 6104, 6105, 6109, 6110, 6111.
b. For checking sensitivity, frequency and delay characteristic, proceed as follows:
— Take flex PCBs of sockets A10 and A11.
— Take plugs A18, A17, A12, A13, A14 and A15 out of sockets.

Attention: do not take of plug A16 (= supply!).

— Unscrew PCB to enable injection at the copper side of the PCB.

Checking sensitivity

— Inject V_{in} = 140 mV_{eff}, 50 kHz on points A102, A101 via R = 100 kΩ and C = 39 pF (see Fig. A).
— V_{out} has to be 245 mV ± 2 dB.

Note:

Ensure that injection cord and test cord are identical.

Checking frequency and delay characteristic

— Adjust V_{in} in such a way that V_{out} = 245 mV = 0 dB at 50 kHz.
— Between the injected and the measured sine-wave signal the delay should be 450 ns ± 50 ns at 300 kHz.
This can be measured on the dual beams oscilloscope with V_{in} on beam A and V_{out} on beam B according to Figure B.
— Check frequency and delay characteristic for frequencies given below:

Frequency (kHz)	V_{out} (dB)	Delay (n sec.)	Delay, compared with delay at 300 kHz
1	—15 ±3		
6,3	— 2 ±1		
16	— 0,5 ±1		
50	0		
100	0 ±1		—50 ±20
200	+ 1 ±1		0 ±20
300	+ 1,5 ±1	450 ±50	0
500	+ 3,5 ±1		+20 ±20
700	+ 5,5 ±2		+30 ±20
1000	+ 8 ±2		+30 ±20
1600	+ 8 ±2		
2000	+ 4,5 ±3		

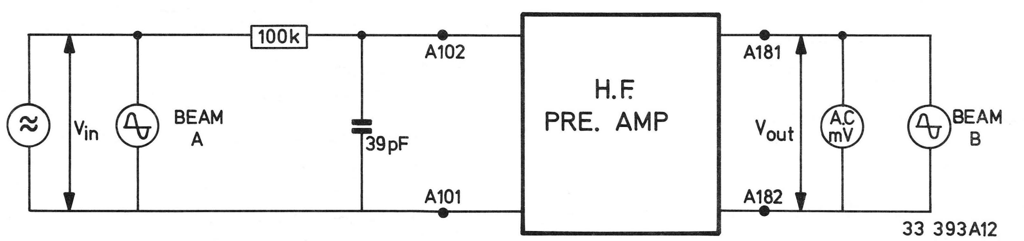


Fig. A

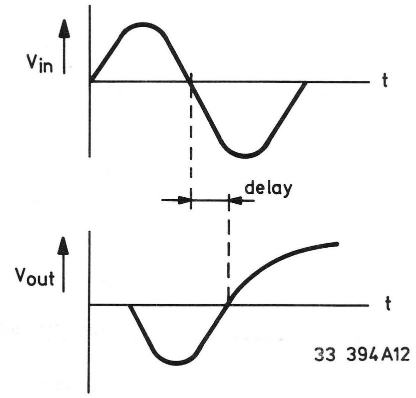
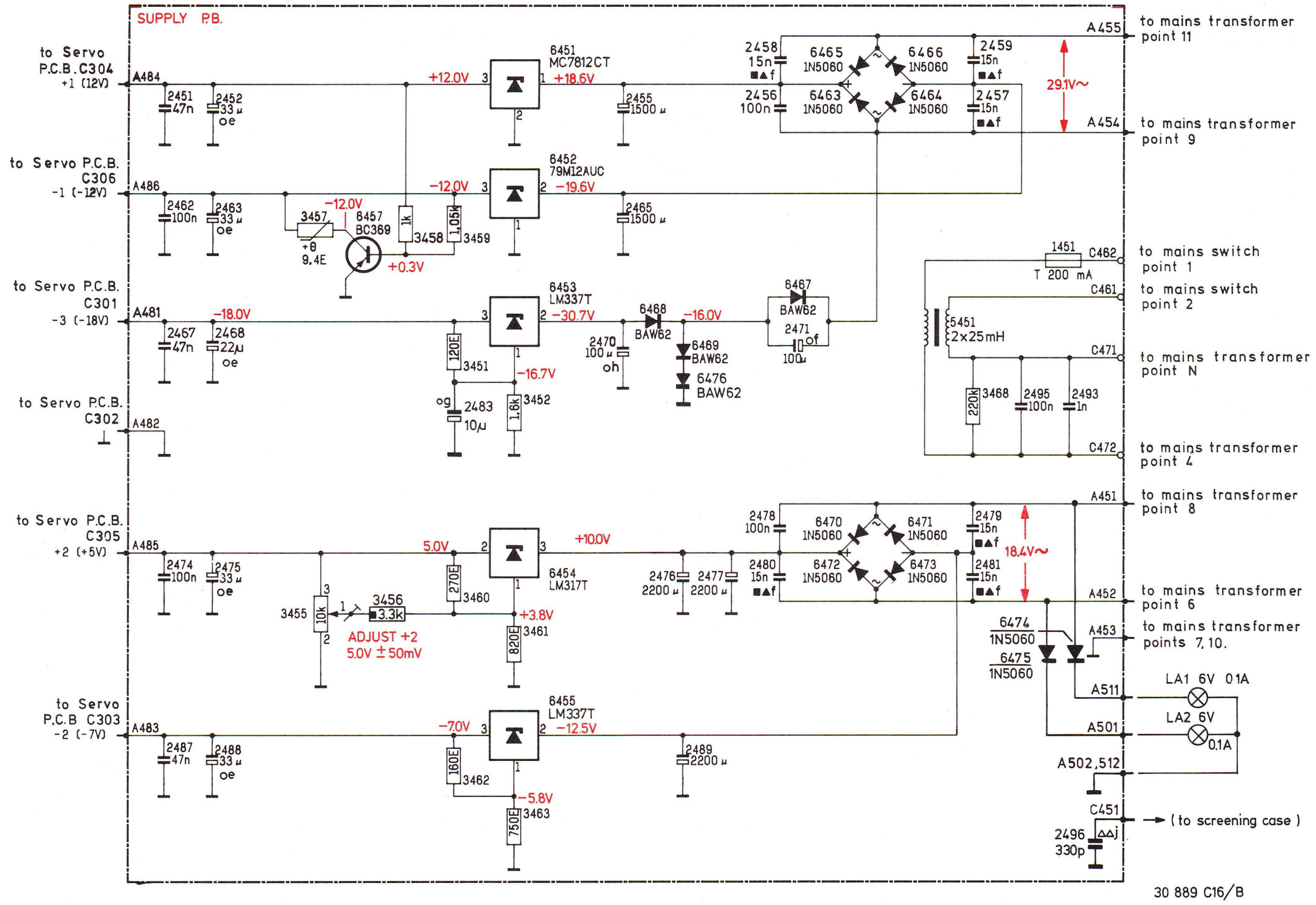
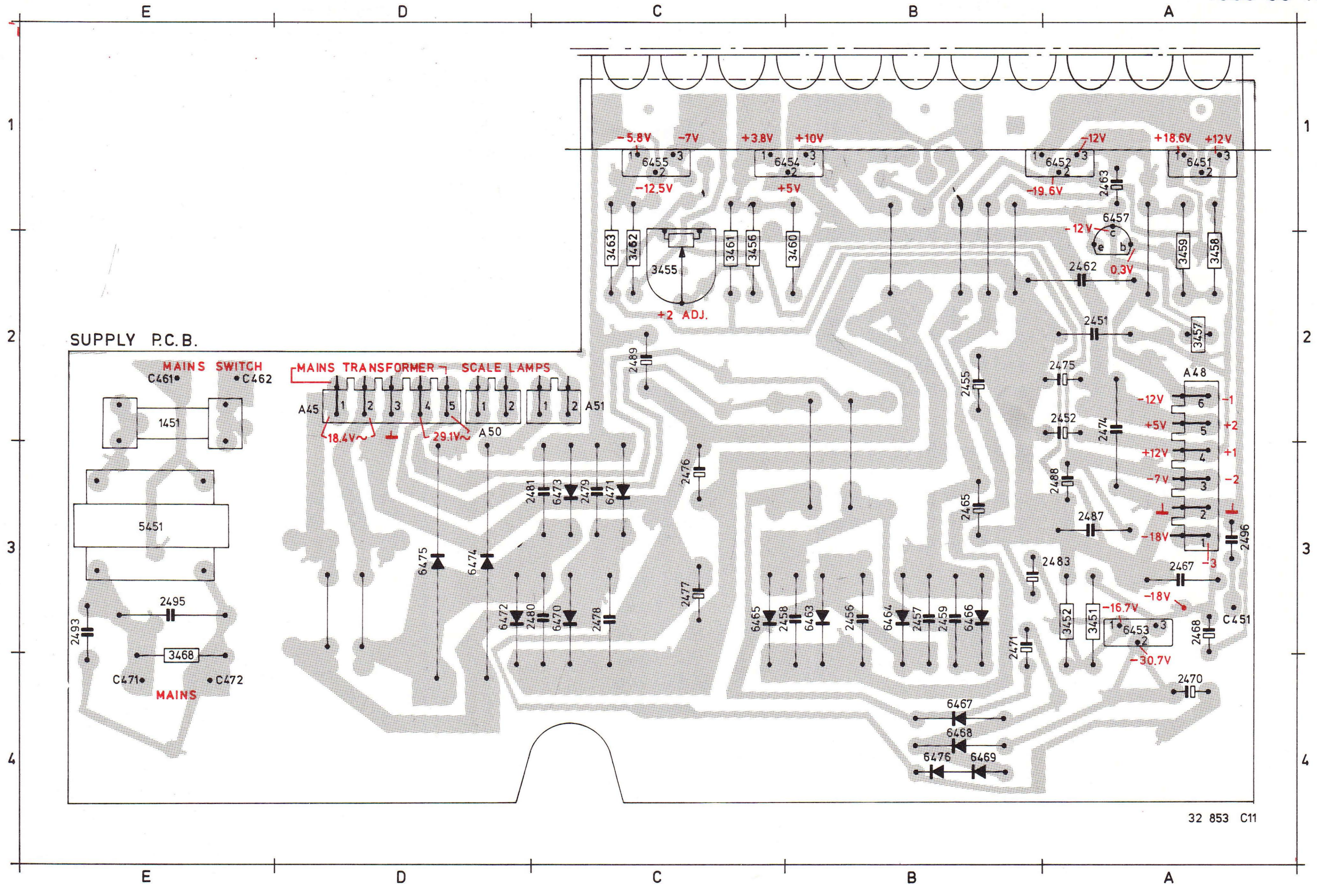


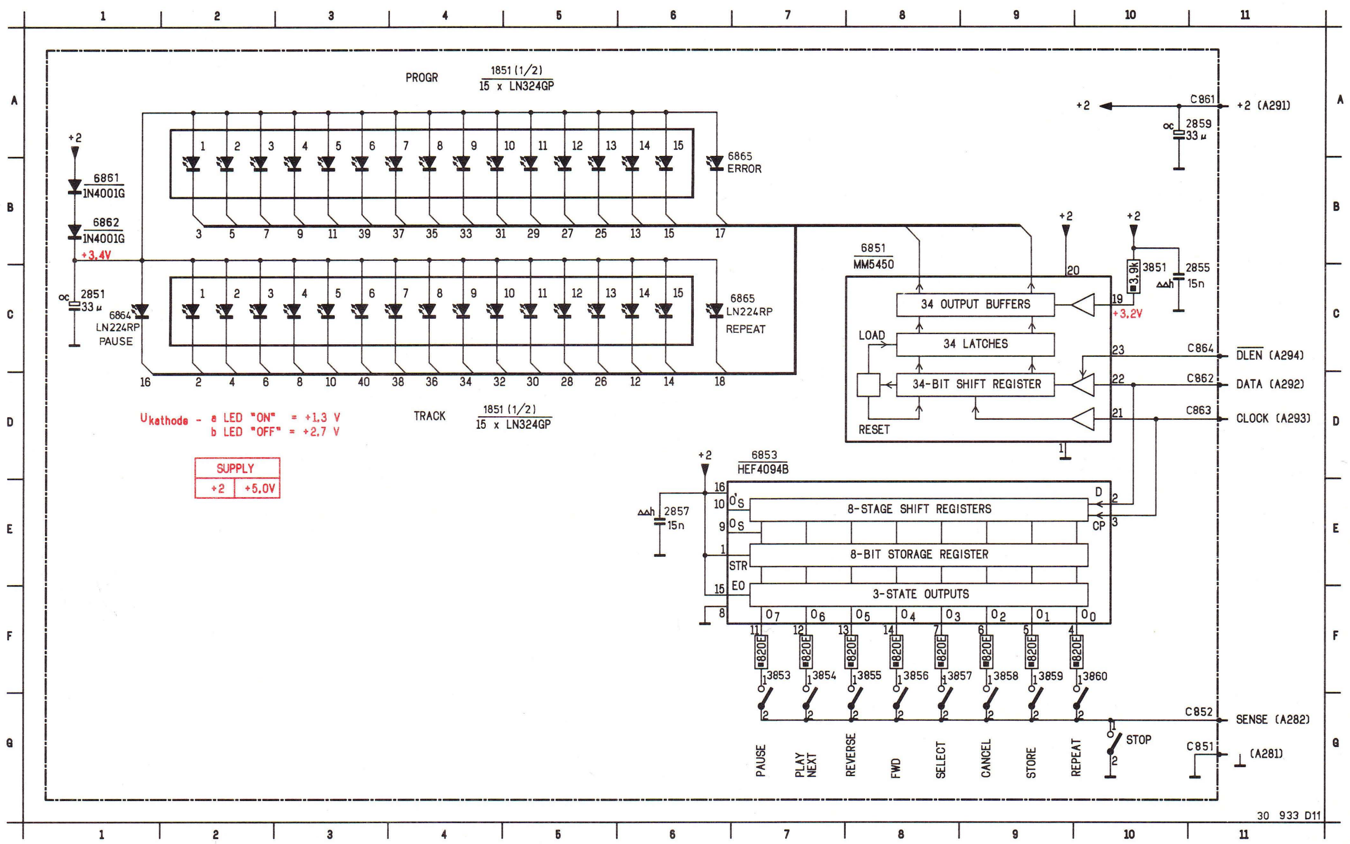
Fig. B

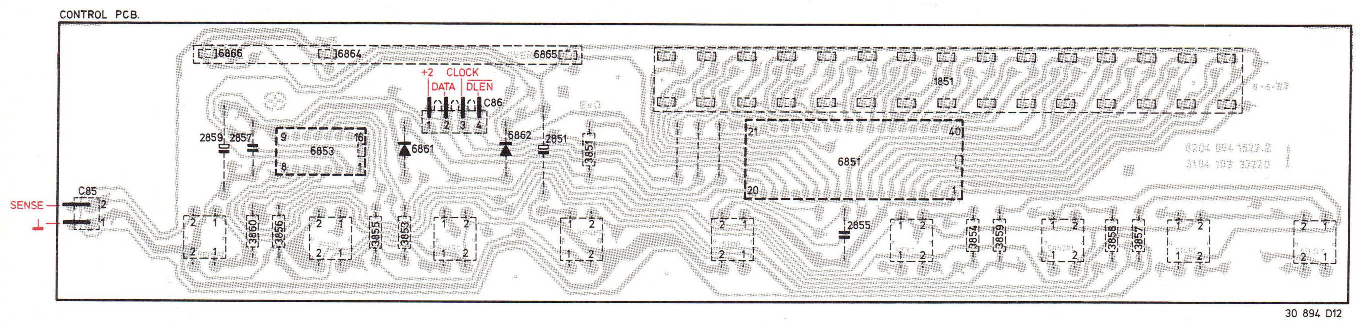
CIRCUIT DIAGRAM A (SUPPLY)





CIRCUIT DIAGRAM B (DISPLAY + CONTROL)



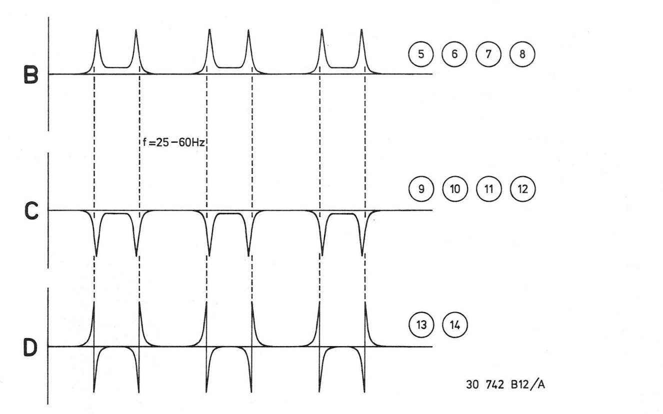


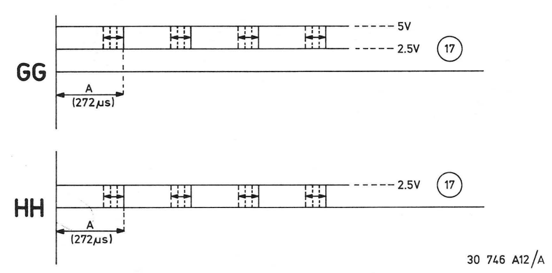
SERVO

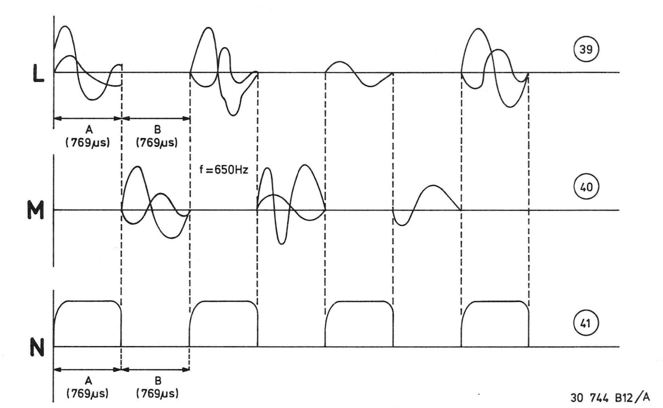
Nr.	See	Position	Amplitude	f	Time base	
1		see fault finding meth.				
2	P	see fault finding meth.	1 Vp-p	10 Hz		
3	P	see fault finding meth.	9 Vp-p	10 Hz		
4	P	see fault finding meth.	8 Vp-p	10 Hz		
5	B	see fault finding meth.	40-80 mV	25-60 Hz		
6	B	see fault finding meth.	40-80 mV	25-60 Hz		
7	B	see fault finding meth.	40-80 mV	25-60 Hz		
8	B	see fault finding meth.	40-80 mV	25-60 Hz		
9	C	see fault finding meth.	—2 V	25-60 Hz		
10	C	see fault finding meth.	—2 V	25-60 Hz		
11	C	see fault finding meth.	—2 V	25-60 Hz		
12	C	see fault finding meth.	—2 V	25-60 Hz		
13	D	see fault finding meth.	—8 V, +8 V	25-60 Hz		
14	D	see fault finding meth.	depends on R3158	25-60 Hz		
15		see fault finding meth.				
17	GG	see fault finding meth.	2,5-5 V		A= 272 µs	
17	HH	see fault finding meth.	0-2,5 V		A= 272 µs	
20		see fault finding meth.				
21	J		12-14 Vp-p			
22	J		0,7 Vp-p			
23	J	Service loop A/	0,7 Vp-p			
24	J	20 —→ ⊥/	0,2 Vp-p			
25	J	5,6 IC6216	0,25 Vp-p			
26	J	interconnected	20 mVp-p			
27	J	*	800 mVp-p			
28	J		800 mVp-p			
29	J		6 Vp-p			
29	P	ON	0,3 Vp-p			
30		see fault finding meth.				
31		see fault finding meth.				
32	*	see fault finding meth.				
33	*	see fault finding meth.				
35	J	20 —→ ⊥/ * service loop A	200 mVp-p			
36	J	20 —→ ⊥/ * service loop A	2 Vp-p			
37	K	20 —→ ⊥/ * service loop A	10 Vp-p			
38	K	20 —→ ⊥/ * service loop A	10 Vp-p			
39	L	20 —→ ⊥/ service loop B*	0-4 Vp-p		A= 769 µs	B= 769 µs
40	K	20 —→ ⊥/ service loop A*	9 Vp-p		A= 769 µs	B= 769 µs
40	M	20 —→ ⊥/ service loop B*	0,4 Vp-p		A= 769 µs	B= 769 µs
41	N	20 —→ ⊥/ service loop B*	6 Vp-p		A= 769 µs	B= 769 µs
45	P	ON	9 Vp-p	650 Hz		
46	Q	ON	0-5 V	650 Hz	A= 769 µs	B= 769 µs
47	P	ON	1,5 Vp-p	650 Hz		
48	P	ON	1 Vp-p	650 Hz		
49	R	ON	0-5 V	650 Hz		
50	S	ON	0-5 V	650 Hz		
51	T	ON	5-0 V	650 Hz		
51	U	Service loop B	5 V	650 Hz		
52		see fault finding meth.				
55	Y	Service loop A	5-0 V			
55	W	play (with test disc)	5-0 V			
56	W	play (with test disc)	5-0 V			
57		see fault finding meth.				
60	X	Service loop A	5-3 V			
61	Y	Service loop A	5-0 V			
62	Y	Service loop A	5-0 V			
63	Y	Service loop A	5-0 V			
65	A	play	1 Vp-p			
67	J	Service loop A/ 20 —→ ⊥/ * 5,6 IC6216 interconnected	200 mVp-p			

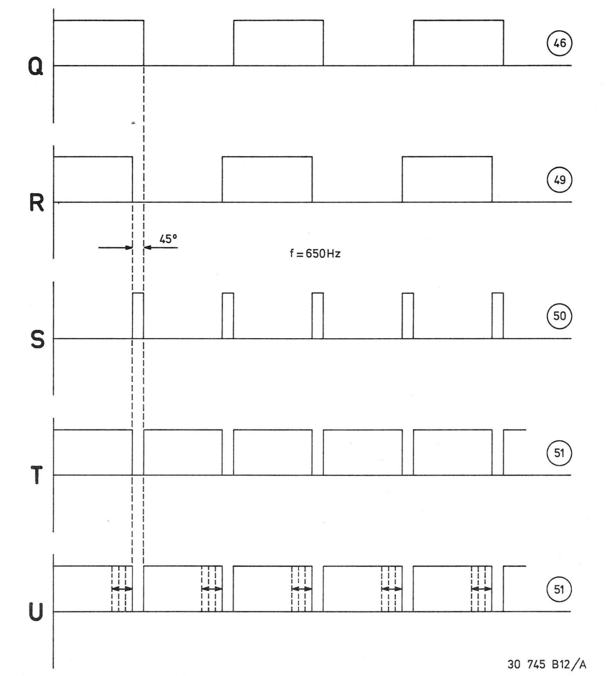
*If trimming potentiometer 3315 has not been used, a resistor of 330 kΩ should be mounted between the measuring points 32 and 33

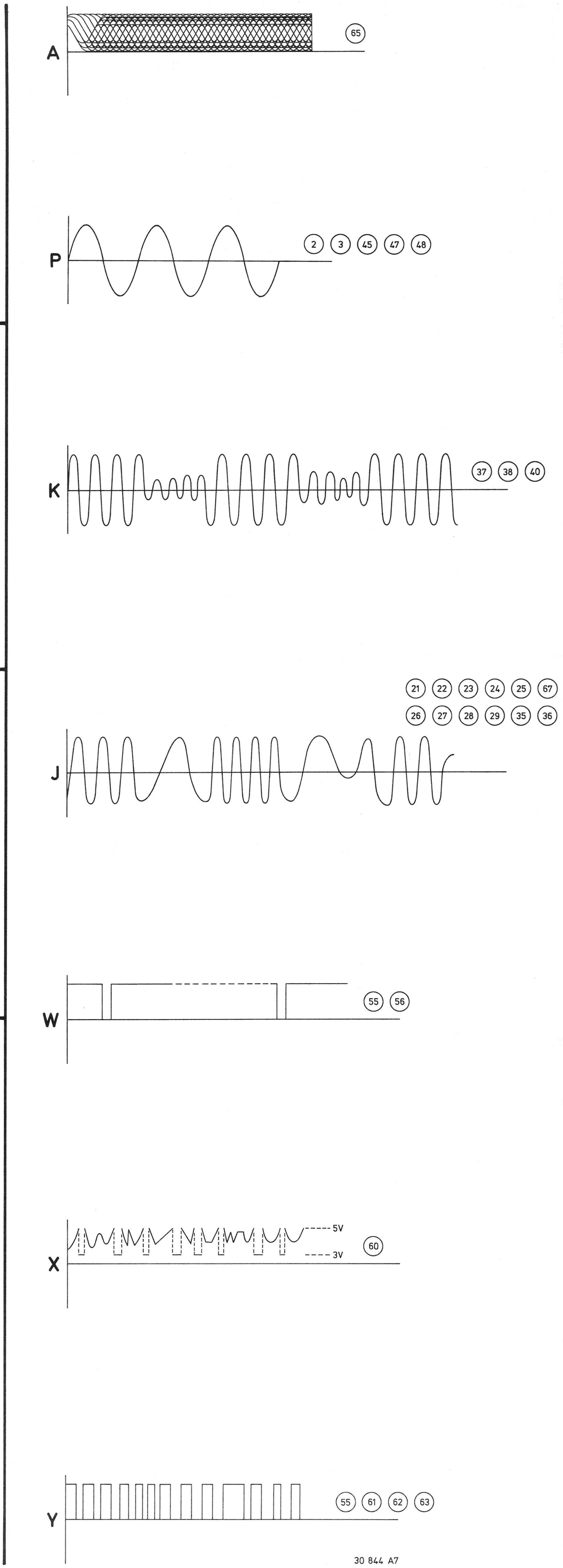
SERVO

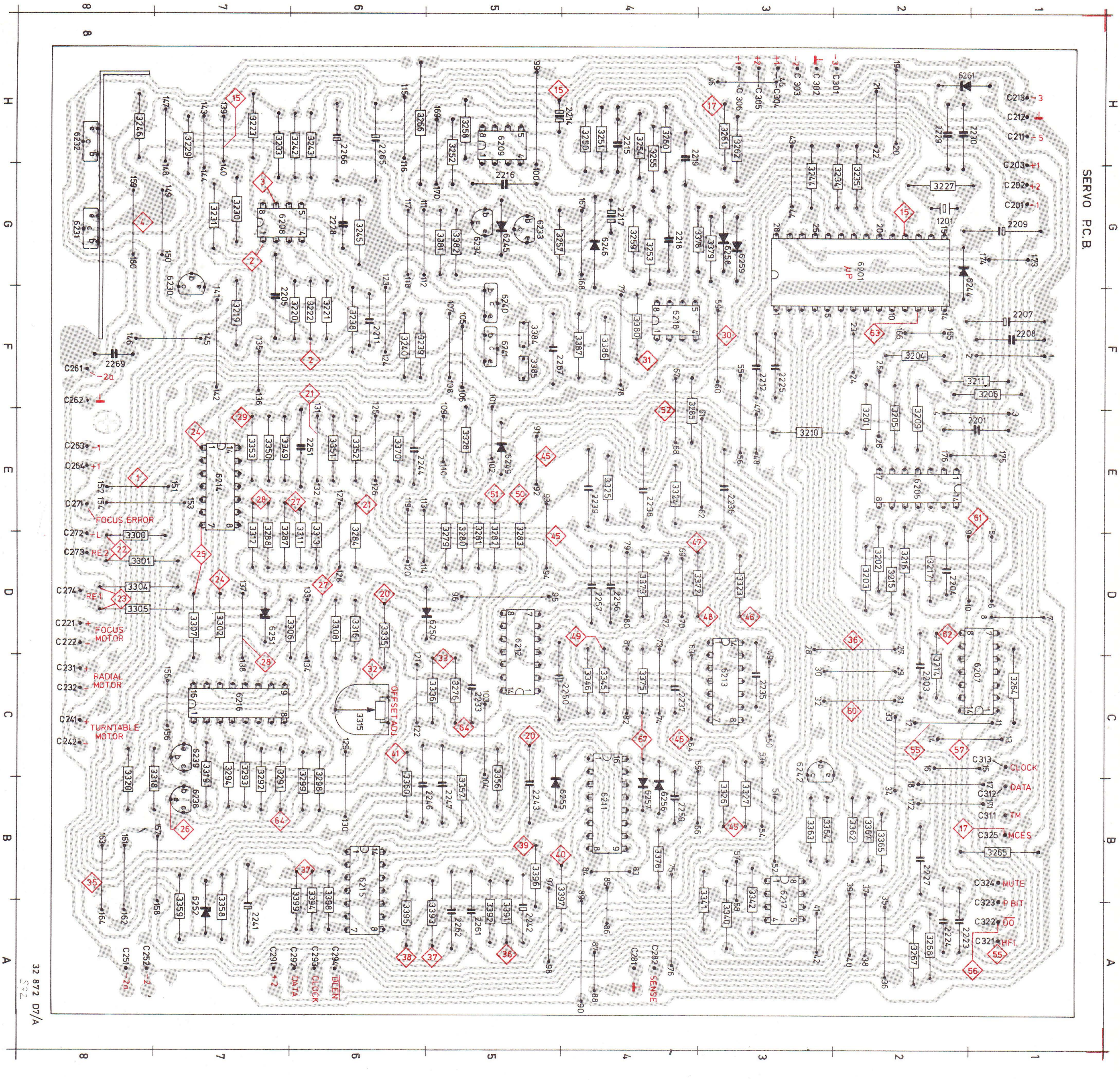






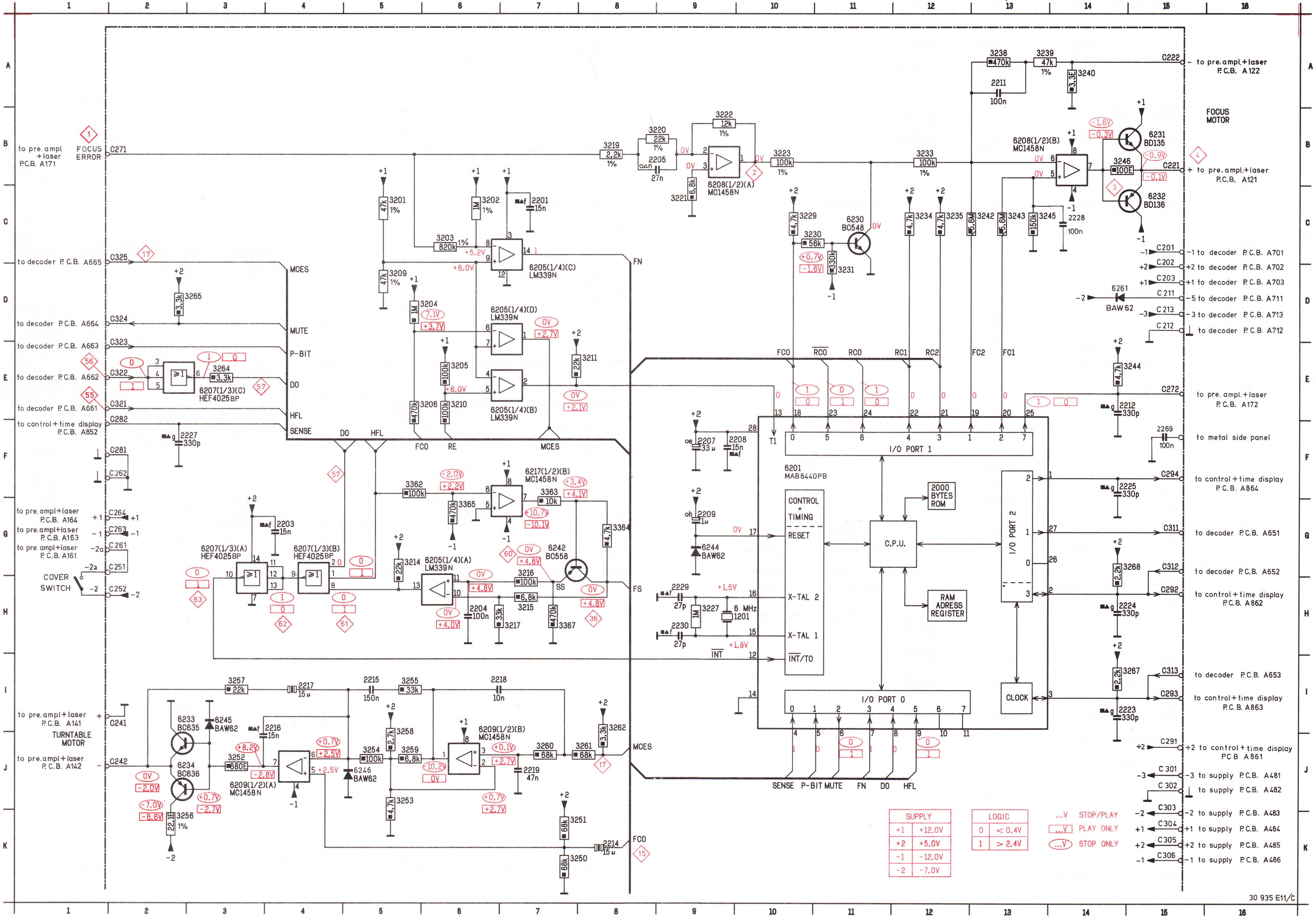





SERVO P.C.B.
FOCUS ERROR
FOCUS MOTOR
RADIAL MOTOR
TURNTABLE MOTOR
OFFSET ADJ
CLOCK
DATA
TM
MCES
MUTE
P BIT
DO
HFL
SENSE
DLEN
32 872 D7/A

CIRCUIT DIAGRAM (SERVO FOCUS, TURNTABLE AND SERVO μP)

1201	H10
2201	C 7
2203	G 4
2204	H 6
2205	B 9
2207	F 9
2208	F10
2209	G 9
2211	A13
2212	E15
2214	K 8
2215	I 5
2216	I 4
2217	I 4
2218	I 7
2219	J 7
2223	I15
2224	H15
2225	F15
2227	F 3
2228	C 14
2229	H 9
2230	H 9
2269	F 15
3201	C 5
3202	C 6
3203	C 6
3204	D 6
3205	E 6
3206	E 6
3209	D 5
3210	E 6
3211	E 8
3214	G 5
3215	H 7
3216	G 7
3217	H 7
3219	B 8
3220	B 9
3221	C 9
3222	B 9
3223	B10
3227	H 9
3229	C10
3230	C10
3231	D11
3233	B12
3234	C12
3235	C12
3238	A13
3239	A13
3240	A14
3242	C13
3243	C13
3244	E15
3245	C13
3247	E14
3250	K 8
3251	K 8
3252	J 3
3253	J 5
3254	J 5
3255	I 5
3256	K 3
3257	I 3
3258	I 5
3259	J 5
3260	J 7
3261	J 8
3262	I 8
3264	E 3
3265	D 3
3267	I15
3268	G15
3362	F 5
3363	F 7
3364	G 8
3365	G 6
3367	H 7
6201	F10
6205	E 7
6205	G 6
6205	D 7
6205	D 7
6207	E 3
6207	G 4
6207	G 3
6208	B13
6208	B 9
6209	I 6
6209	J 3
6217	F 7
6230	C11
6231	B15
6232	C15
6233	I 3
6234	J 3
6242	G 7
6244	G 9
6245	I 3
6246	J 5
6261	D14



SUPPLY	
+1	+12,0V
+2	+5,0V
-1	-12,0V
-2	-7,0V

LOGIC	
0	< 0,4V
1	> 2,4V

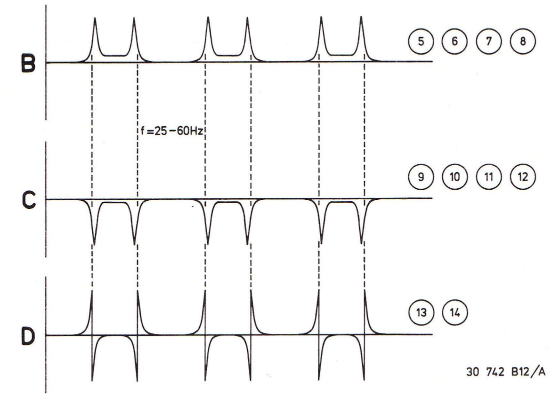
30 935 E11/C

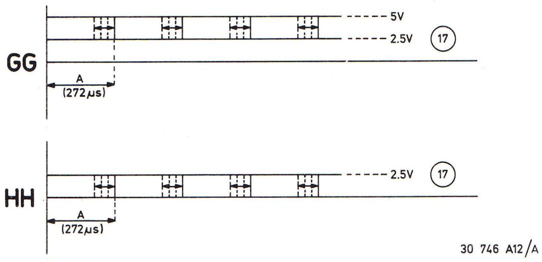
SERVO

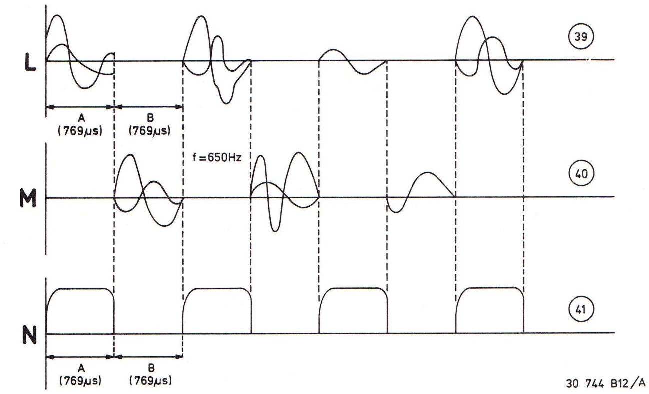
Nr.	See	Position	Amplitude	f	Time base	
1		see fault finding meth.				
2	P	see fault finding meth.	1 Vp-p	10 Hz		
3	P	see fault finding meth.	9 Vp-p	10 Hz		
4	P	see fault finding meth.	8 Vp-p	10 Hz		
5	B	see fault finding meth.	40-80 mV	25-60 Hz		
6	B	see fault finding meth.	40-80 mV	25-60 Hz		
7	B	see fault finding meth.	40-80 mV	25-60 Hz		
8	B	see fault finding meth.	40-80 mV	25-60 Hz		
9	C	see fault finding meth.	—2 V	25-60 Hz		
10	C	see fault finding meth.	—2 V	25-60 Hz		
11	C	see fault finding meth.	—2 V	25-60 Hz		
12	C	see fault finding meth.	—2 V	25-60 Hz		
13	D	see fault finding meth.	—8 V, +8 V	25-60 Hz		
14	D	see fault finding meth.	depends on R3158	25-60 Hz		
15		see fault finding meth.				
17	GG	see fault finding meth.	2,5-5 V		A= 272 μs	
17	HH	see fault finding meth.	0-2,5 V		A= 272 μs	
20		see fault finding meth.				
21	J		12-14 Vp-p			
22	J		0,7 Vp-p			
23	J	Service loop A/	0,7 Vp-p			
24	J	20 → ⊥/	0,2 Vp-p			
25	J	5,6 IC6216	0,25 Vp-p			
26	J	interconnected	20 mVp-p			
27	J	*	800 mVp-p			
28	J		800 mVp-p			
29	J		6 Vp-p			
29	P	ON	0,3 Vp-p			
30		see fault finding meth.				
31		see fault finding meth.				
32	*	see fault finding meth.				
33	*	see fault finding meth.				
35	J	20 → ⊥/ * service loop A	200 mVp-p			
36	J	20 → ⊥/ * service loop A	2 Vp-p			
37	K	20 → ⊥/ * service loop A	10 Vp-p			
38	K	20 → ⊥/ * service loop A	10 Vp-p			
39	L	20 → ⊥/ service loop B*	0-4 Vp-p		A= 769 μs	B= 769 μs
40	K	20 → ⊥/ service loop A*	9 Vp-p		A= 769 μs	B= 769 μs
40	M	20 → ⊥/ service loop B*	0,4 Vp-p		A= 769 μs	B= 769 μs
41	N	20 → ⊥/ service loop B*	6 Vp-p		A= 769 μs	B= 769 μs
45	P	ON	9 Vp-p	650 Hz		
46	Q	ON	0-5 V	650 Hz	A= 769 μs	B= 769 μs
47	P	ON	1,5 Vp-p	650 Hz		
48	P	ON	1 Vp-p	650 Hz		
49	R	ON	0-5 V	650 Hz		
50	S	ON	0-5 V	650 Hz		
51	T	ON	5-0 V	650 Hz		
51	U	Service loop B	5 V	650 Hz		
52		see fault finding meth.				
55	Y	Service loop A	5-0 V			
55	W	play (with test disc)	5-0 V			
56	W	play (with test disc)	5-0 V			
57		see fault finding meth.				
60	X	Service loop A	5-3 V			
61	Y	Service loop A	5-0 V			
62	Y	Service loop A	5-0 V			
63	Y	Service loop A	5-0 V			
65	A	play	1 Vp-p			
67	J	Service loop A/ 20 → ⊥/ * 5,6 IC6216 interconnected	200 mVp-p			

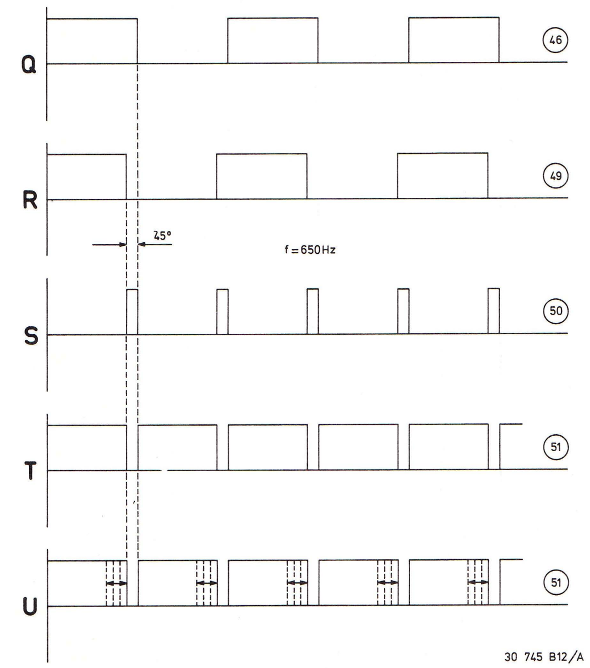
*If trimming potentiometer 3315 has not been used, a resistor of 330 kΩ should be mounted between the measuring points 32 and 33

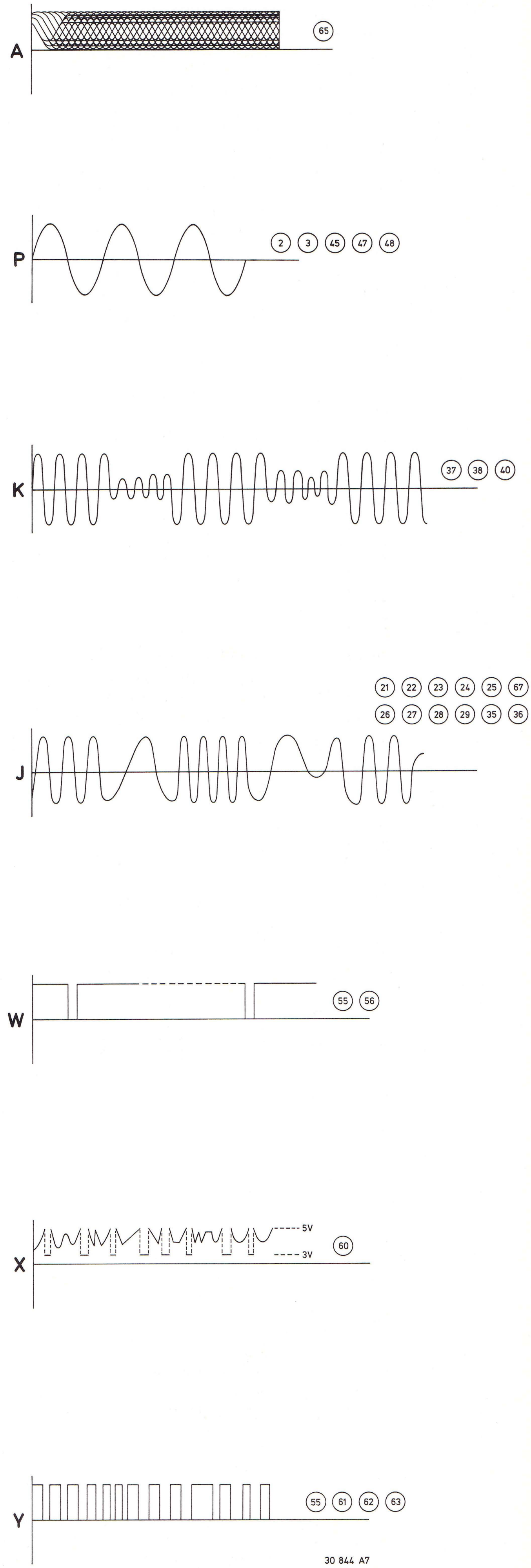
SERVO

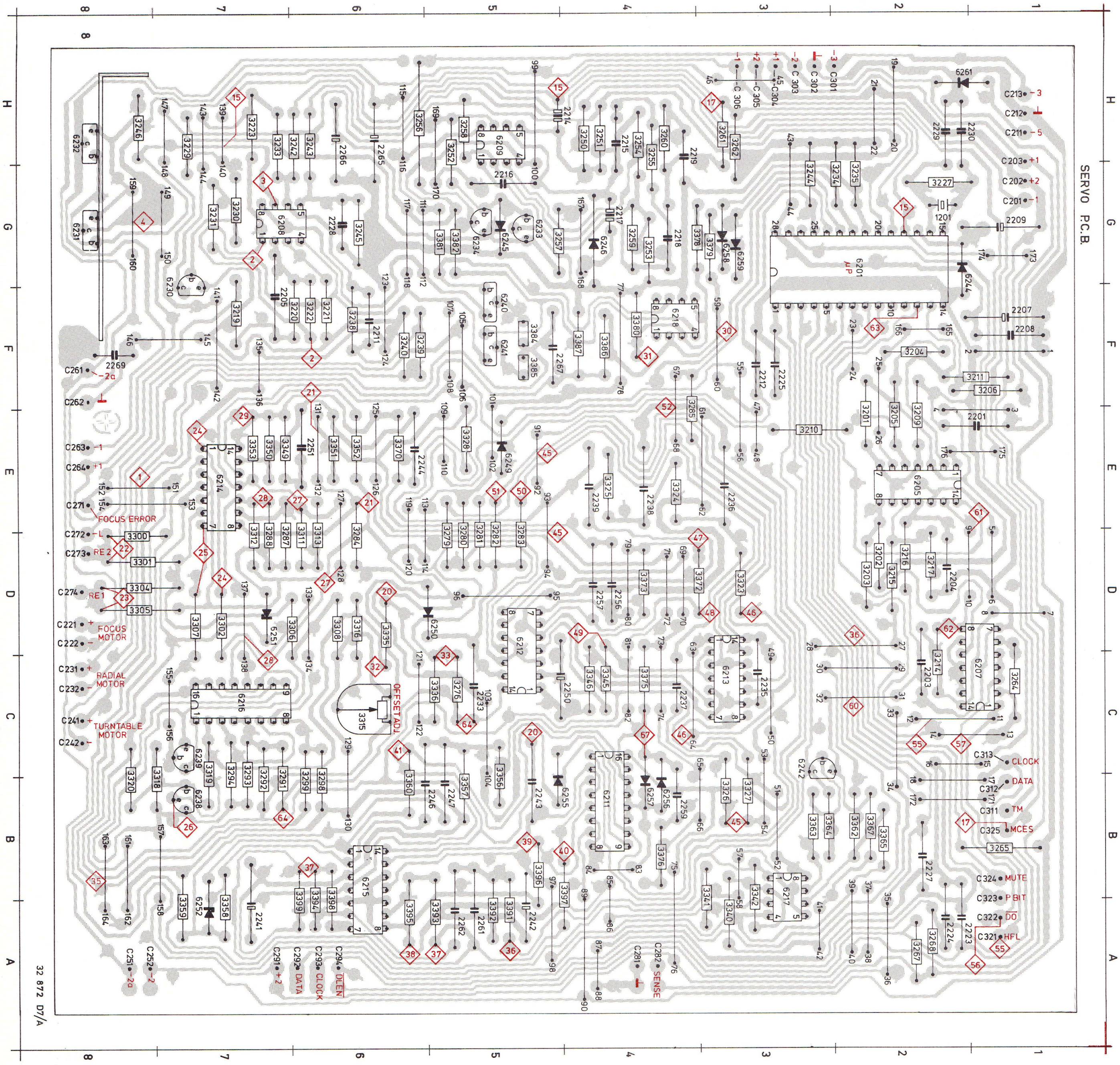

B
C
D
f=25–60Hz
5 6 7 8
9 10 11 12
13 14
30 742 B12/A


GG
HH
5V
2.5V
17
A
(272µs)
2.5V
17
A
(272µs)
30 746 A12/A


L
M
N
39
40
41
A
(769µs)
B
(769µs)
f=650Hz
A
(769µs)
B
(769µs)
30 744 B12/A

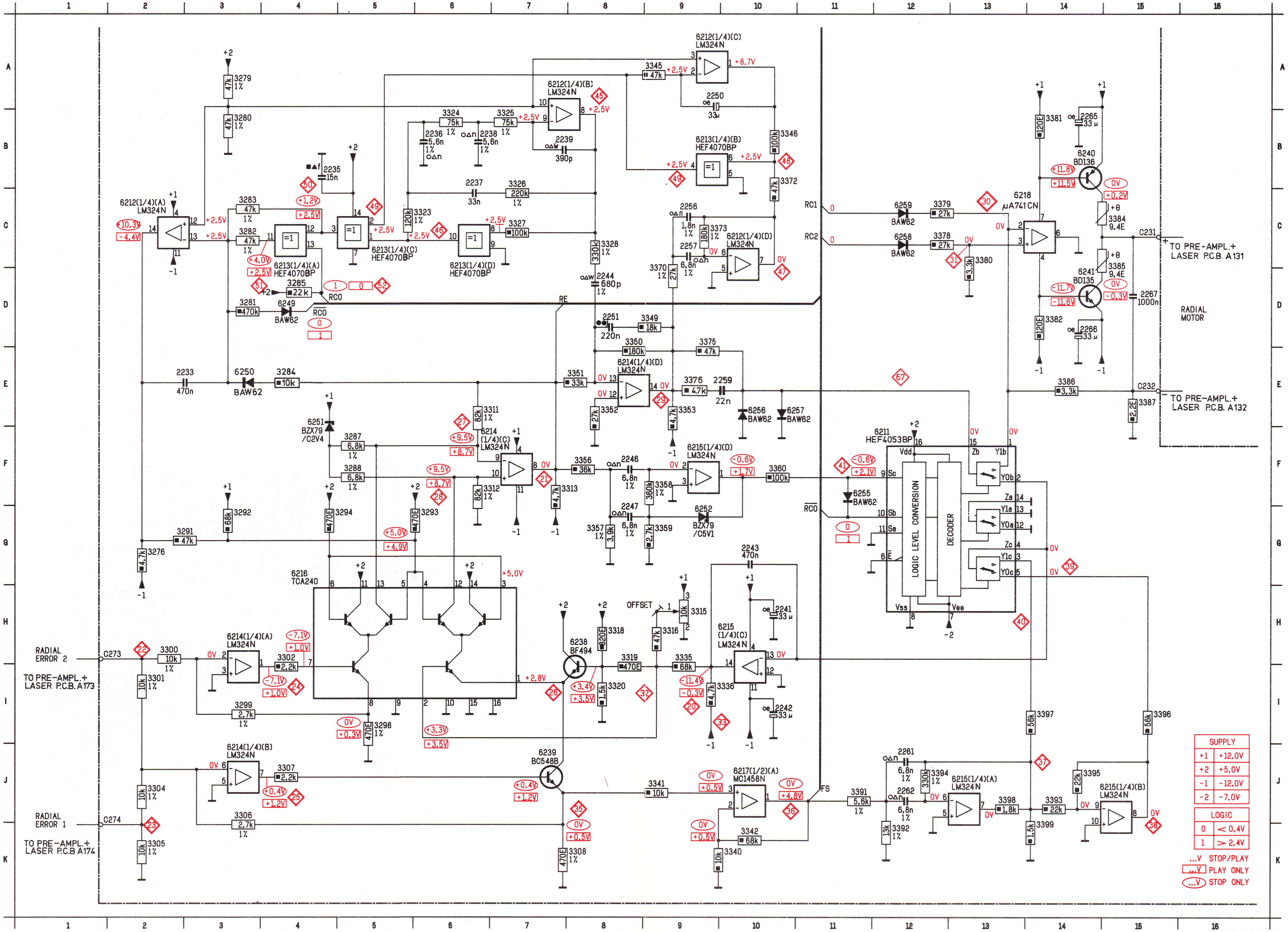

Q
R
S
T
U
46
49
50
51
51
45°
f=650Hz
30 745 B12/A


A
65
P
2 3 45 47 48
K
37 38 40
21 22 23 24 25 67
26 27 28 29 35 36
J
W
55 56
X
5V
3V
60
Y
55 61 62 63
30 844 A7


SERVO P.C.B.
μP
FOCUS ERROR
RE 2
RE 1
FOCUS MOTOR
RADIAL MOTOR
TURNTABLE MOTOR
OFFSET ADJ
CLOCK
DATA
TM
MCES
MUTE
P BIT
DO
HFL
SENSE
DLEN
32 872 D7/A

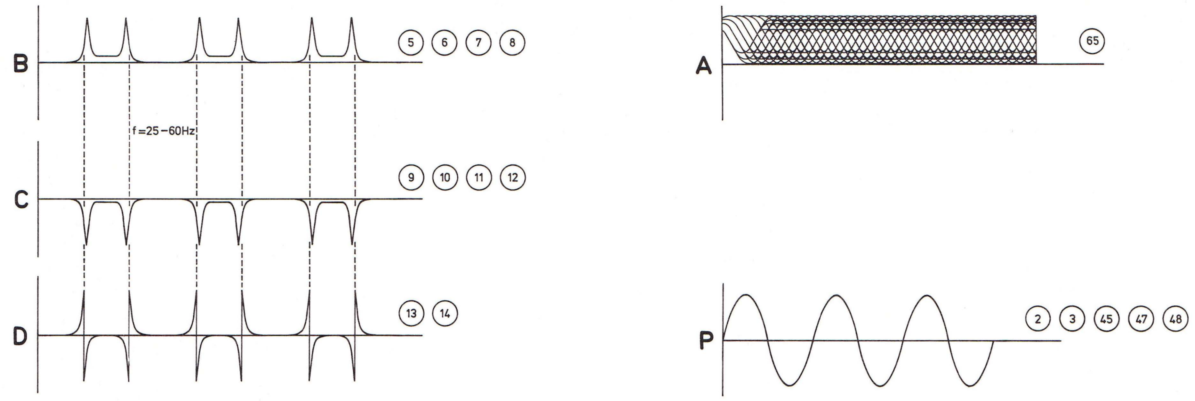
CIRCUIT DIAGRAM D (SERVO RADIAL MOTOR)

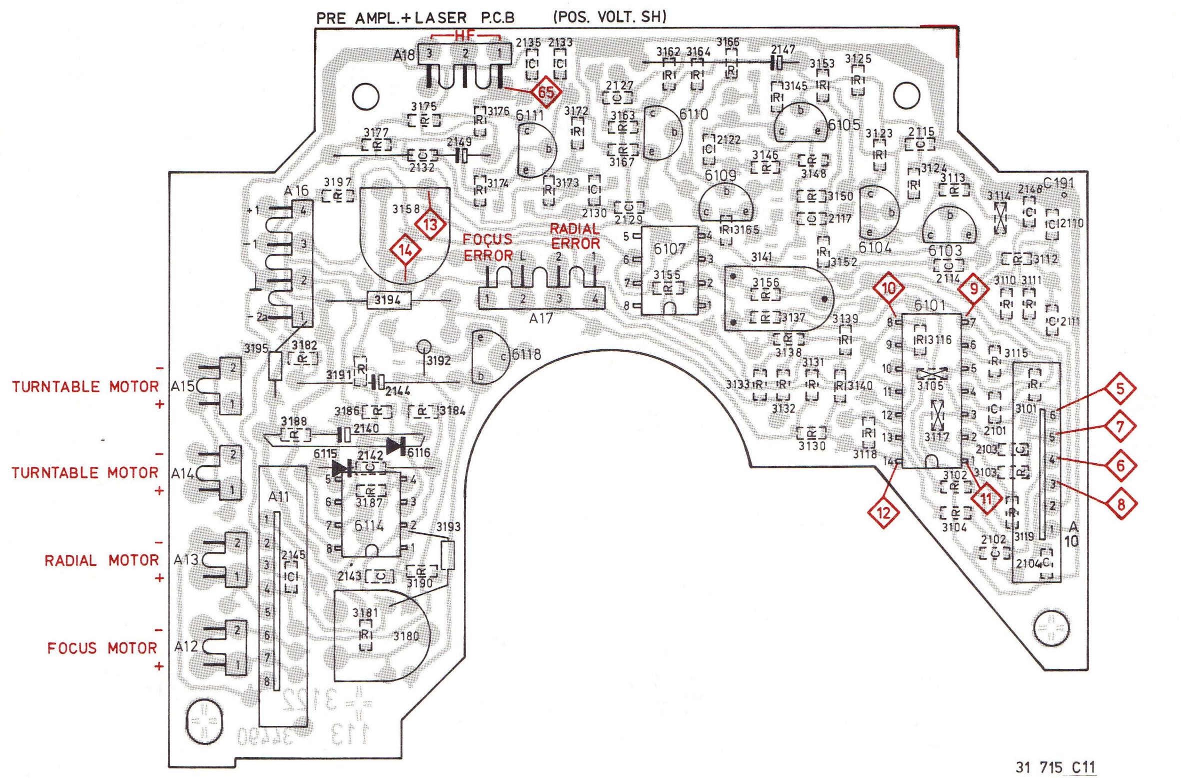
Part	Pos.	Part	Pos.	Part	Pos.
2233	E 3	2241	H10	2250	A 9
2235	B 4	2242	I10	2251	D 8
2236	B 6	2243	G10	2256	C 9
2237	B 6	2244	D 8	2257	C 9
2238	B 6	2246	F 8	2259	E 9
2239	B 7	2247	G 8	2261	J12
2262	J12	3280	B 3	3287	F 5
2265	B14	3281	D 3	3288	F 5
2266	D14	3282	C 3	3291	G 3
2267	D15	3283	C 3	3292	G 3
3276	G 2	3284	E 4	3293	G 6
3279	A 3	3285	D 4	3294	G 5
				3298	I 5
3299	I 3	3306	J 3	3315	H 9
3300	H 2	3307	J 4	3316	H 9
3301	I 2	3308	K 8	3318	H 8
3302	H 4	3311	E 7	3319	H 8
3304	J 2	3312	F 7	3320	I 8
3305	K 2	3313	F 8	3323	C 6
3324	B 6	3336	I10	3349	D 9
3325	B 7	3340	K10	3350	D 8
3326	B 7	3341	J 9	3351	E 8
3327	C 7	3342	K10	3352	E 8
3328	C 8	3345	A 9	3353	E 9
3335	H 9	3346	B10	3356	F 8
3357	G 8	3373	C 9	3381	B14
3358	F 9	3375	D 9	3382	D14
3359	G 9	3376	E10	3384	C15
3360	F10	3378	C12	3385	C15
3370	D 9	3379	C12	3386	E14
3372	B10	3380	C13	3387	E15
3391	J11	3397	I14	6212	C10
3392	K12	3398	J13	6212	A 9
3393	J14	3399	K14	6213	C 4
3394	J12	6211	F12	6213	B 9
3395	J14	6212	A 7	6213	C 6
3396	I15	6212	C 2	6213	C 5
6214	J 3	6215	J13	6239	J 7
6214	H 3	6215	J15	6240	B14
6214	E 8	6216	G 4	6241	D14
6214	F 7	6217	J10	6249	D 4
6215	H10	6218	C13	6250	E 3
6215	F 9	6238	H 8	6251	E 4
6252	G 9				
6255	F11				
6256	E10				
6257	E11				
6258	C12				
6259	C12				



Nr.	See	Position	Amplitude	f	Time base
1		see fault finding meth.			
2	P	see fault finding meth.	1 Vp-p	10 Hz	
3	P	see fault finding meth.	9 Vp-p	10 Hz	
4	P	see fault finding meth.	8 Vp-p	10 Hz	
5	B	see fault finding meth.	40-80 mV	25-60 Hz	
6	B	see fault finding meth.	40-80 mV	25-60 Hz	
7	B	see fault finding meth.	40-80 mV	25-60 Hz	
8	B	see fault finding meth.	40-80 mV	25-60 Hz	
9	C	see fault finding meth.	—2 V	25-60 Hz	
10	C	see fault finding meth.	—2 V	25-60 Hz	
11	C	see fault finding meth.	—2 V	25-60 Hz	
12	C	see fault finding meth.	—2 V	25-60 Hz	
13	D	see fault finding meth.	—8 V, +8 V	25-60 Hz	
14	D	see fault finding meth.	depends on R3158	25-60 Hz	
15		see fault finding meth.			
17	GG	see fault finding meth.	2,5-5 V		A= 272 µs
17	HH	see fault finding meth.	0-2,5 V		A= 272 µs
20		see fault finding meth.			
21	J		12-14 Vp-p		
22	J		0,7 Vp-p		
23	J	Service loop A/	0,7 Vp-p		
24	J	20 —→ ⊥/	0,2 Vp-p		
25	J	5,6 IC6216	0,25 Vp-p		
26	J	interconnected	20 mVp-p		
27	J	*	800 mVp-p		
28	J		800 mVp-p		
29	J		6 Vp-p		
29	P	ON	0,3 Vp-p		
30		see fault finding meth.			
31		see fault finding meth.			
32	*	see fault finding meth.			
33	*	see fault finding meth.			
35	J	20 —→ ⊥/ * service loop A	200 mVp-p		
36	J	20 —→ ⊥/ * service loop A	2 Vp-p		
37	K	20 —→ ⊥/ * service loop A	10 Vp-p		
38	K	20 —→ ⊥/ * service loop A	10 Vp-p		
39	L	20 —→ ⊥/ service loop B*	0-4 Vp-p		A= 769 µs B= 769 µs
40	K	20 —→ ⊥/ service loop A*	9 Vp-p		A= 769 µs B= 769 µs
40	M	20 —→ ⊥/ service loop B*	0,4 Vp-p		A= 769 µs B= 769 µs
41	N	20 —→ ⊥/ service loop B*	6 Vp-p		A= 769 µs B= 769 µs
45	P	ON	9 Vp-p	650 Hz	
46	Q	ON	0-5 V	650 Hz	A= 769 µs B= 769 µs
47	P	ON	1,5 Vp-p	650 Hz	
48	P	ON	1 Vp-p	650 Hz	
49	R	ON	0-5 V	650 Hz	
50	S	ON	0-5 V	650 Hz	
51	T	ON	5-0 V	650 Hz	
51	U	Service loop B	5 V	650 Hz	
52		see fault finding meth.			
55	Y	Service loop A	5-0 V		
55	W	play (with test disc)	5-0 V		
56	W	play (with test disc)	5-0 V		
57		see fault finding meth.			
60	X	Service loop A	5-3 V		
61	Y	Service loop A	5-0 V		
62	Y	Service loop A	5-0 V		
63	Y	Service loop A	5-0 V		
65	A	play	1 Vp-p		
67	J	Service loop A/ 20 —→ ⊥/ * 5,6 IC6216 interconnected	200 mVp-p		

*If trimming potentiometer 3315 has not been used, a resistor of 330 kΩ should be mounted between the measuring points 32 and 33.





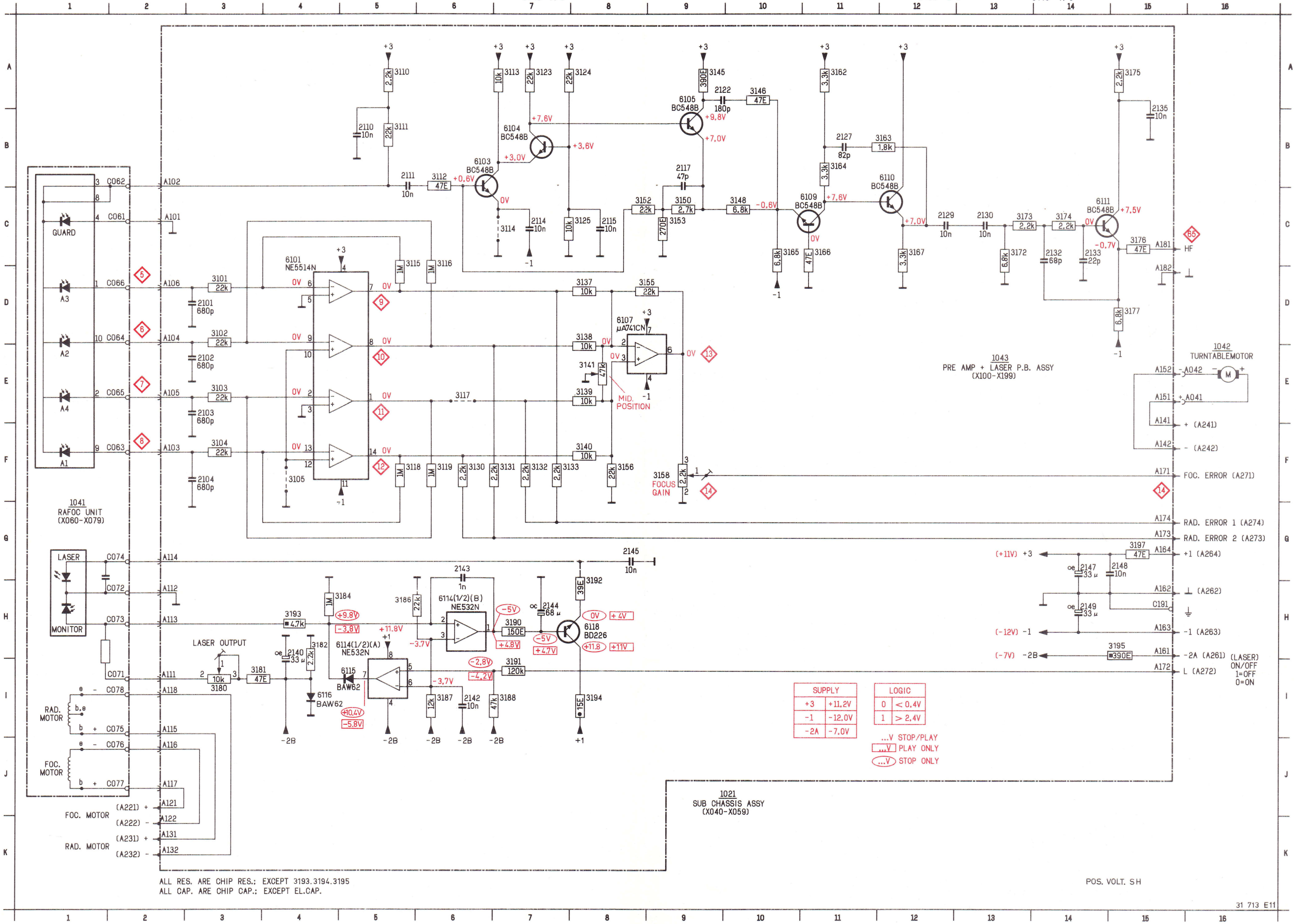
CIRCUIT DIAGRAM E (LASER SUPPLY, MONITOR DIODES AND HF PRE-AMP).

2101	D 3	2111	B 5	2127	B11	2135	A15	2147	G14
2102	E 3	2114	C 7	2129	C12	2140	H 4	2148	G15
2103	E 3	2115	C 8	2130	C13	2142	I 6	2149	H14
2104	F 3	2117	B 9	2132	C14	2144	H 7	3101	D 3
2110	B 5	2122	A 9	2133	C14	2145	G 8	3102	D 3

3103	E 3	3112	B 6	3117	E 6	3125	C 8	3137	D 8
3104	F 3	3113	A 7	3118	F 5	3130	F 6	3138	D 8
3105	F 4	3114	C 7	3119	F 6	3131	F 7	3139	E 8
3110	A 5	3115	C 5	3123	A 7	3132	F 7	3140	F 8
3111	B 5	3116	C 6	3124	A 8	3133	F 8	3141	E 8
								3145	A 9

3146	K 1	3155	D 9	3164	B11	3172	C13	3177	D15
3148	K 1	3156	F 8	3165	C10	3173	C13	3180	I 3
3150	K 1	3158	F 9	3166	C11	3174	C14	3181	I 3
3152	K 1	3162	A11	3167	C12	3175	A15	3184	H 5
3153	C 9	3163	B12			3176	C15	3186	H 6

3187	I 6	3193	H 4	6104	B 7	6111	C14
3188	I 7	3194	I 8	6105	A 9	6114	H 6
3190	H 7	3195	H14	6107	D 8	6114	H 5
3191	I 7	3197	G15	6109	C11	6115	I 5
3192	H 8	6101	C 4	6110	B12	6116	I 4
		6103	B 6			6118	H 8

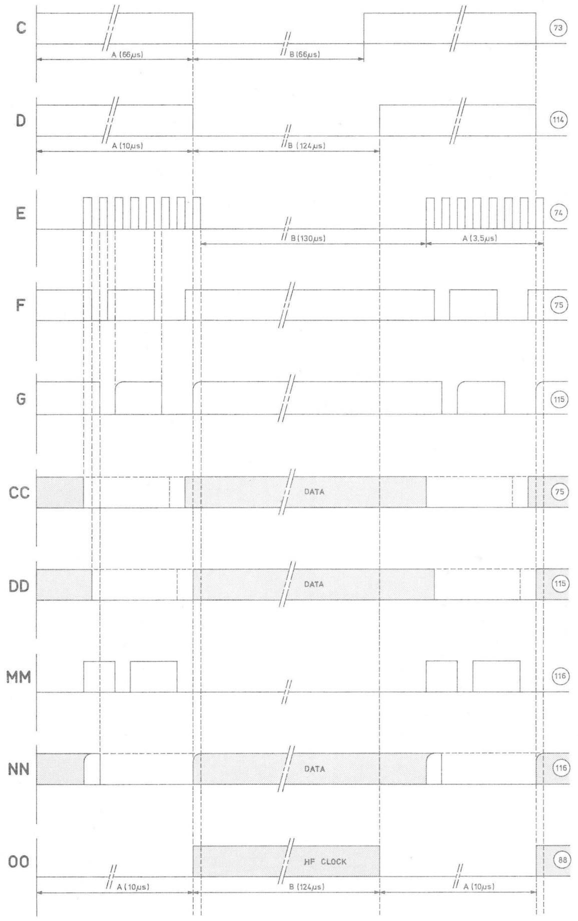


ALL RES. ARE CHIP RES.; EXCEPT 3193.3194.3195
ALL CAP. ARE CHIP CAP.; EXCEPT EL.CAP.

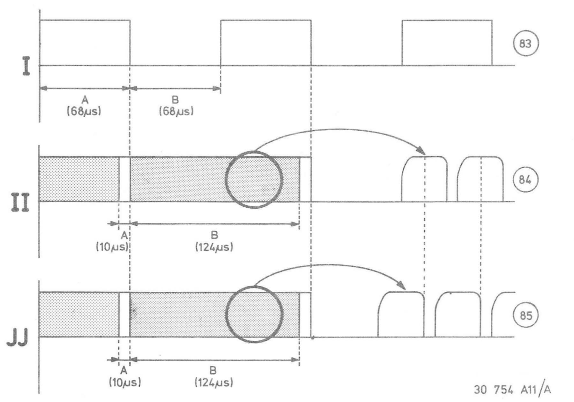
31 713 E11

Nr.	See	Position	Amplitude	f	Time base	
71	A	stop/play	5,5 V	4,32 MHz		
72	B	play	5,5 V		DATA	
73	C*	stop/play	5,5 V	7,5/7,35 kHz	A= 66/68 μs	B= 66/68 μs
74	E	stop/play	5,5 V		A= 3,5 μs	B= 130,5 μs
75	F	stop	5,5 V		A= 3,5 μs	B= 130,5 μs
75	CC	play	5,5 V		A= 0,5 μs	B= 134 μs
76	B	play	5 V		DATA	
77	A	stop/play	5,5 V	8,64 MHz		
78	Z	stop/play	5,5 V	44,1 kHz	A= 11,3 μs	B= 11,3 μs
79	EE	stop/play	5,5 V		A= 3,7 μs	B= 7,6 μs
80	I	stop/play	5 V	7,35 kHz	A= 68 μs	B= 68 μs
81	FF	stop/play	5 V		A= 3,7 μs	B= 7,6 μs
82	B	play	5 V		DATA	
83	I	stop/play	5 V	7,5/7,35 kHz	A= 66/68 μs	B= 66/68 μs
84	II	stop/play	5 V		A= 10 μs	B= 124 μs
85	JJ	stop/play	5 V		A= 10 μs	B= 124 μs
86	M	stop/play	5 V	triggered with 80	A= 3 μs	B= 9,5 μs
87	A	stop/play	5 V	2,16 MHz		
88	OO	stop/play	5,5 V		A= 10 μs	B= 124 μs
89	J	stop/play	5 V	3,75/3,675 kHz	A= 133/136 μs	B= 133/136 μs
90	K	stop/play	5 V	3,675 kHz	A= 136 μs	B= 136 μs
91	L	play	5 V		A= 272 μs	
91	XX	see faultf. method	5-0 V		A= 272 μs	
92	N	stop/play	4 V	4,233 MHz		
93	O	stop/play	4 V	4,233 MHz		
94	P	stop/play	4 V	4,233 MHz		
95	T	stop/play	4 V	264,6 kHz		
96	Q	stop/play	4 V	2,116 MHz		
97	R	stop/play	4 V	1,058 MHz		
98	U	stop/play	4 V		A= 3,7 μs	B= 7,6 μs
99	V	stop/play	4 V		A= 3,7 μs	B= 7,6 μs
100	W	stop/play	4 V	44,1 kHz	A= 11,3 μs	B= 11,3 μs
101	X	stop/play	4 V		A= 3,7 μs	B= 19 μs
102	Y	stop/play	4 V		A= 1,8 μs	B= 20,7 μs
103	AA	stop/play	5 V		A= 22,6 μs	B= 22,6 μs
104	GG	stop/play	5 V		A= 3,7 μs	B= 7,6 μs
105	KK	stop/play	5 V		A= 11,3 μs	B= 11,3 μs
106	X	stop/play	5 V		A= 3,7 μs	B= 19 μs
107	HH	stop/play	5 V	Rep.f=176,4kHz	A= 0,3 μs	B= 5,4 μs
108	LL	stop/play	4 V	Rep.f=176,4kHz	A= 0,2 μs	B= 5,5 μs
109	TT	stop/play	5 V		A= 3,2 μs	B= 2,4 μs
110	UU	stop	5 V		A= 1,2 μs	B= 4,4 μs
110	VV	play	5 V		A= 3,2 μs	B= 2,4 μs
111	UU	stop	5 V		A= 1,2 μs	B= 4,4 μs
111		play	5 V		A= 3,2 μs	B= 2,4 μs
114	D	stop/play	0-5,5 V		A= 10 μs	B= 124 μs
115	G	stop	5,5-0 V			
116	MM	stop	0-5,5 V			
116	NN	play	5-0 V			

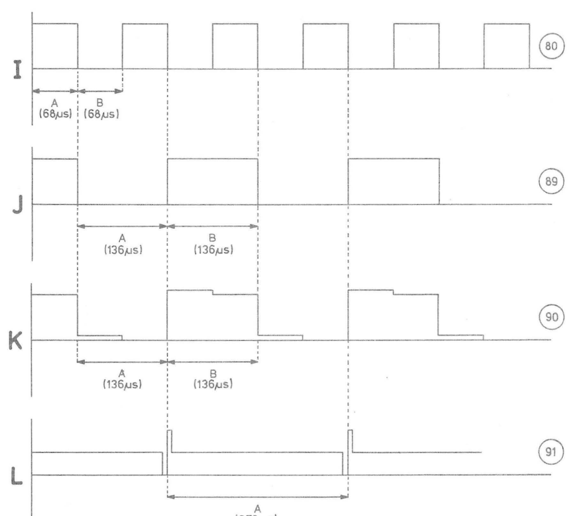
*In pos stop, signal is only present **after** the set was brought in play mode.



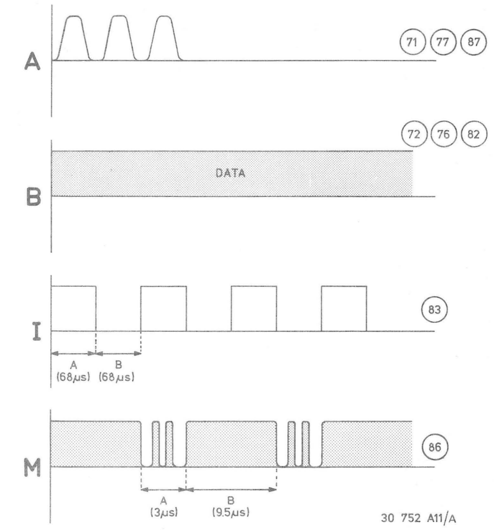
33 425 07



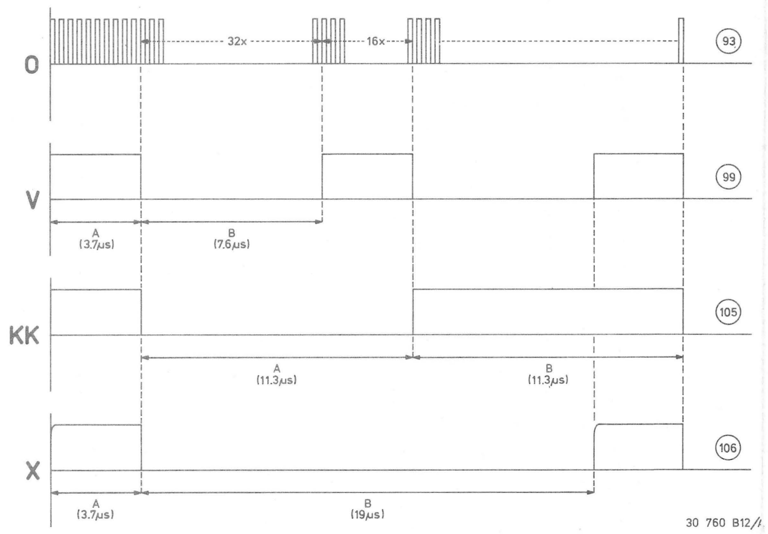
30 754 A11/A



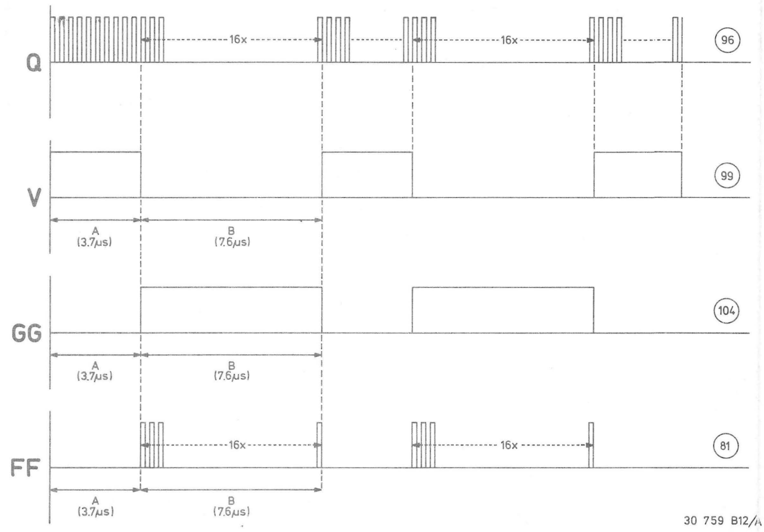
30 755 B11/B



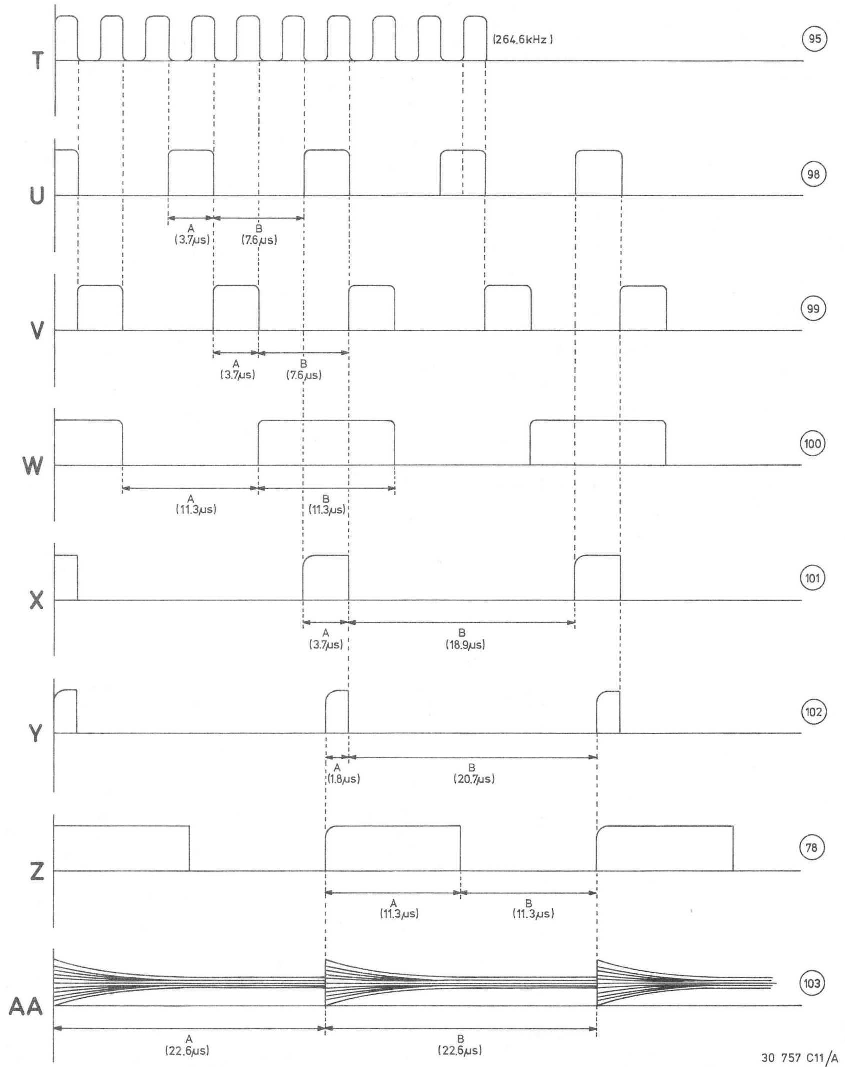
30 752 A11/A



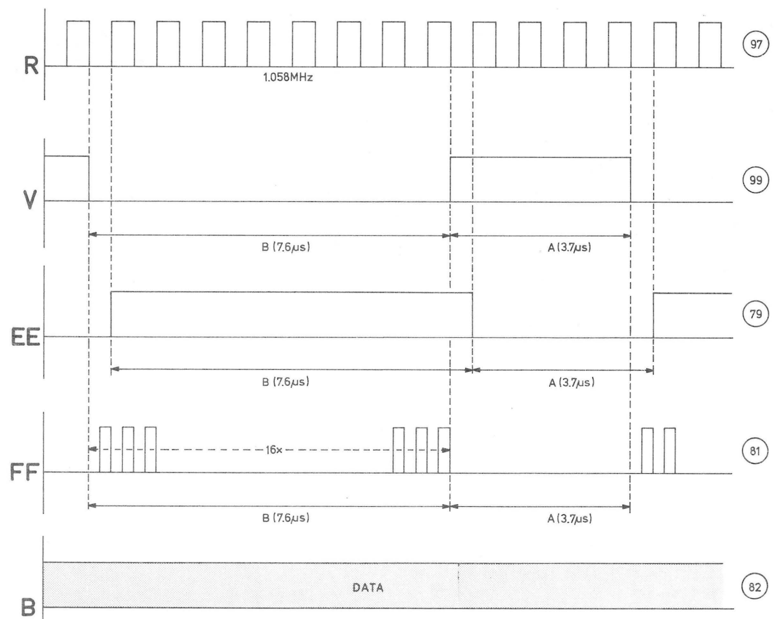
30 760 B12/A



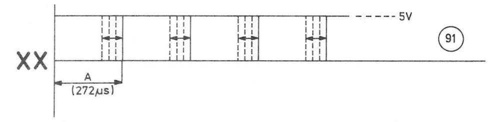
30 759 B12/A



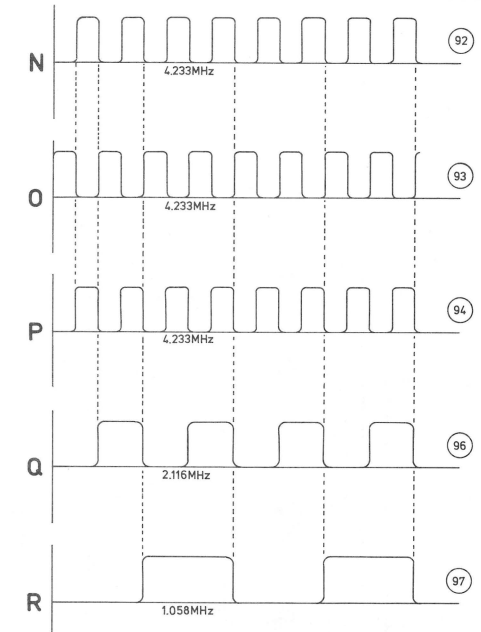
30 757 C11/A



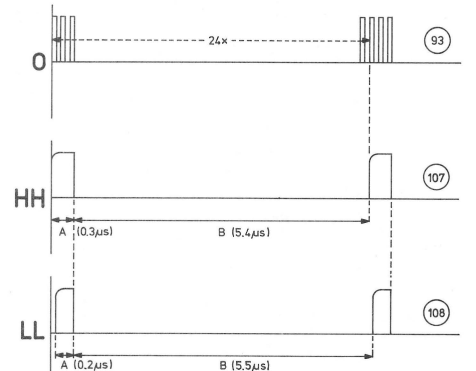
30 869 C21/A



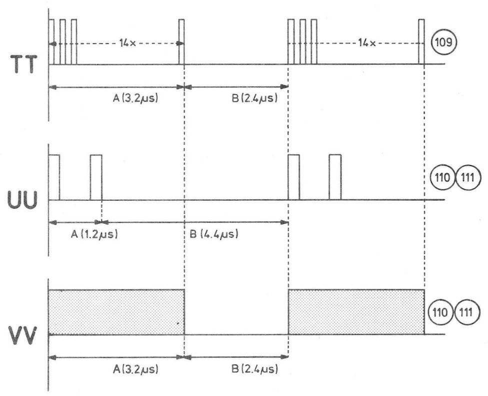
33 791 A12



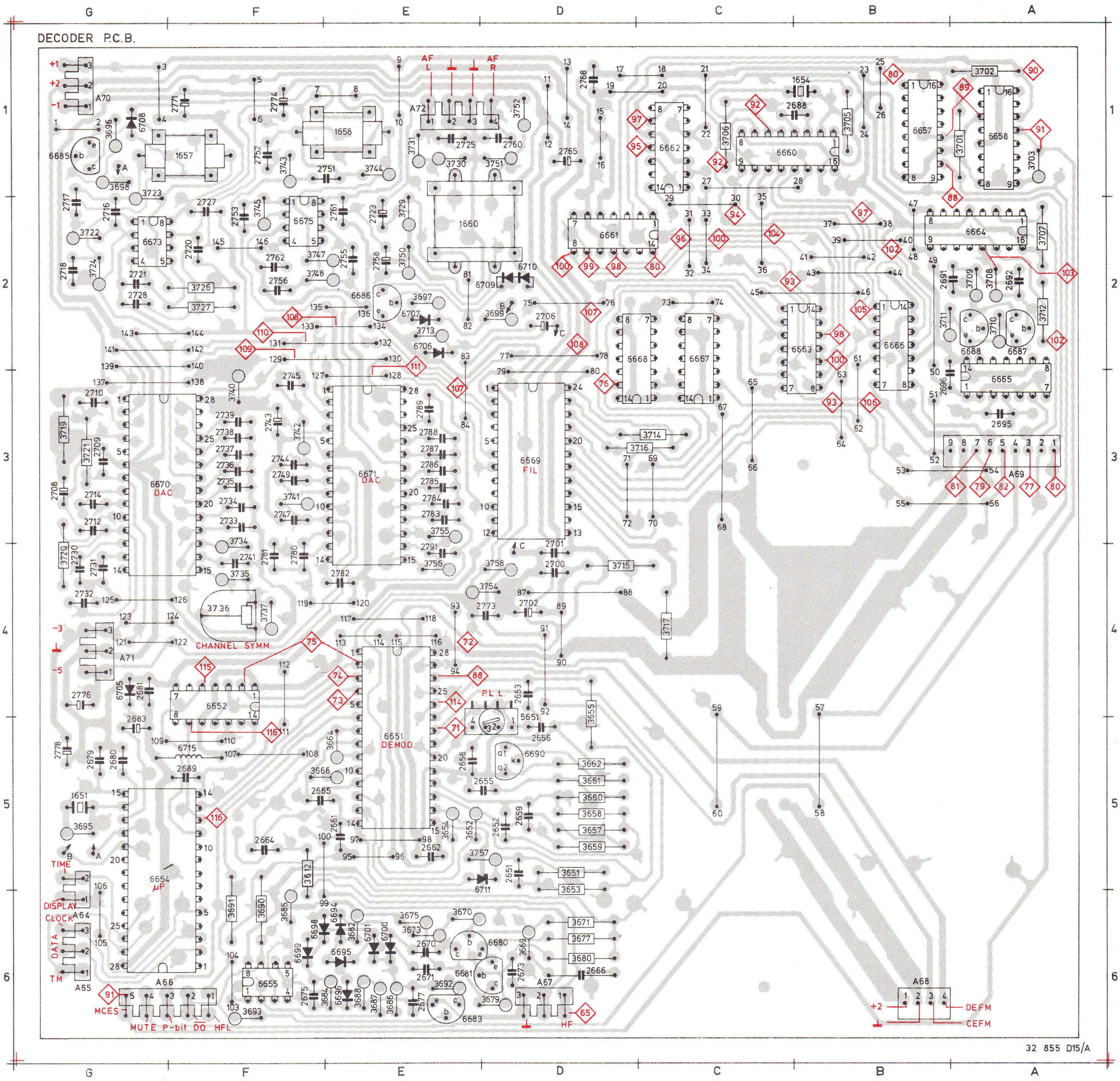
30 756 B11/A



30 761 A12/A



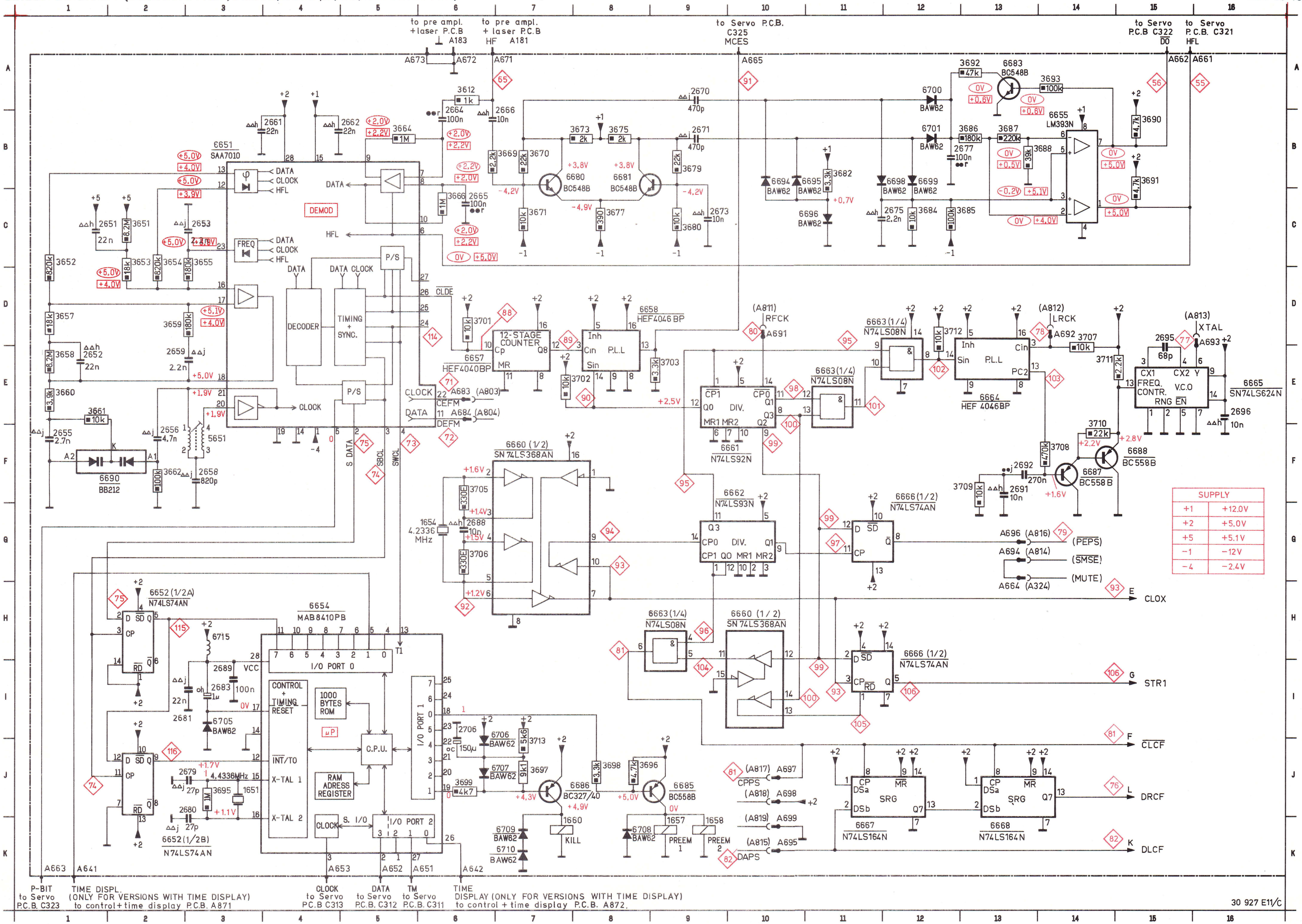
30 906 A11/A



DECODER P.C.B.
G
F
E
D
C
B
A
1
2
3
4
5
6
AF L
AF R
A70
A71
A72
A64
A65
A66
A67
A68
A69
6670 DAC
6671 DAC
6669 FIL
6651 DEMOD
6654 µP
6652
6655
6657
6658
6660
6661
6662
6663
6664
6665
6666
6667
6668
6673
6675
1651
1654
1656
1657
1660
CHANNEL SYMM
P.L.L
TIME
DISPLAY
CLOCK
DATA
TM
MCES
MUTE
P-bit
DO
HFL
HF
+2
DEFM
CEFM
32 855 D15/A

CIRCUIT DIAGRAM F (DECODING PART, DEMOD, DECO μP, DO, HFL DETECTOR)

10-11-a
1983-09-13

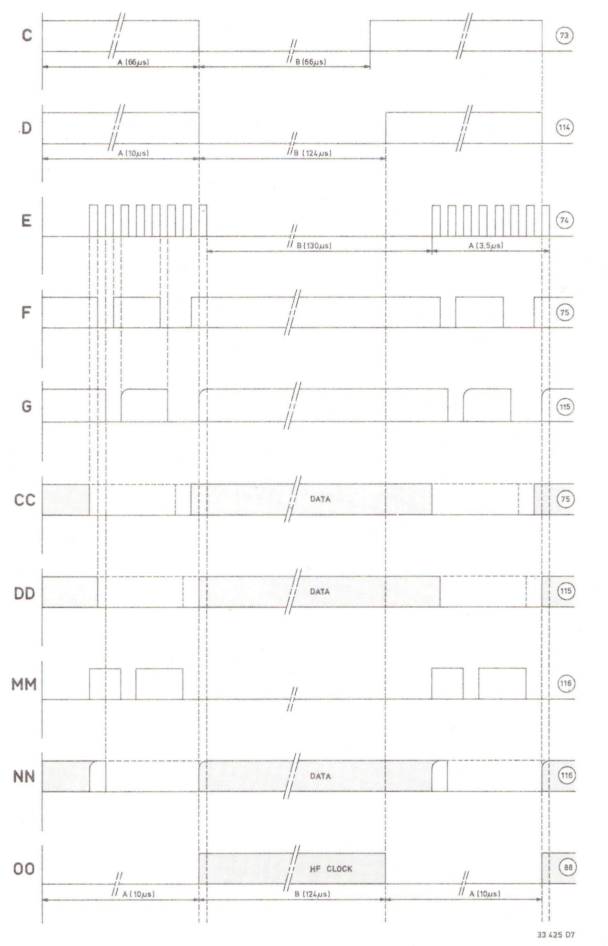


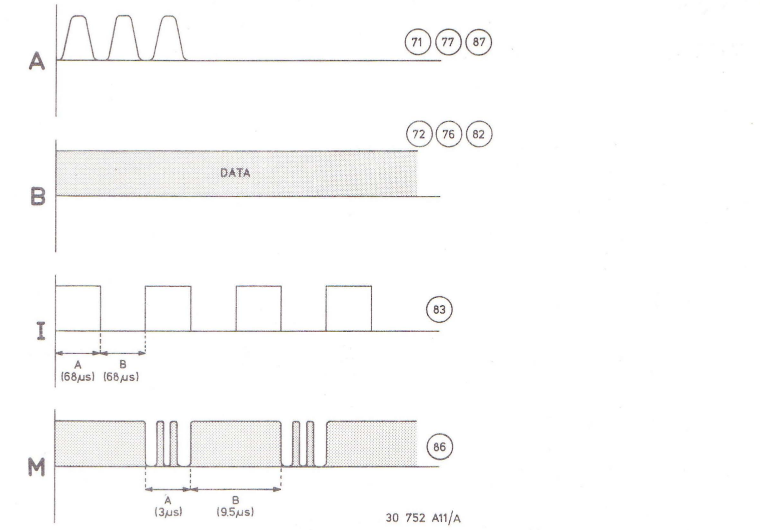
CS 90 328

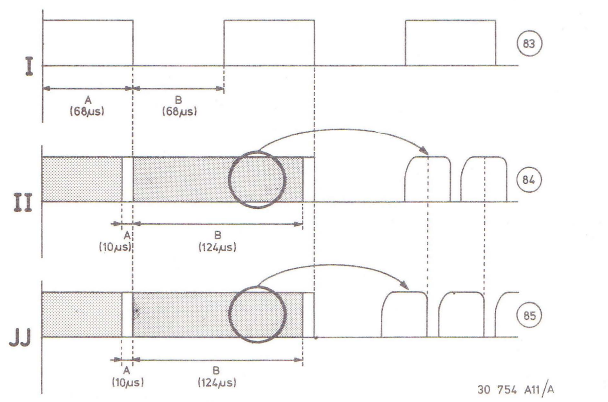
DECODING

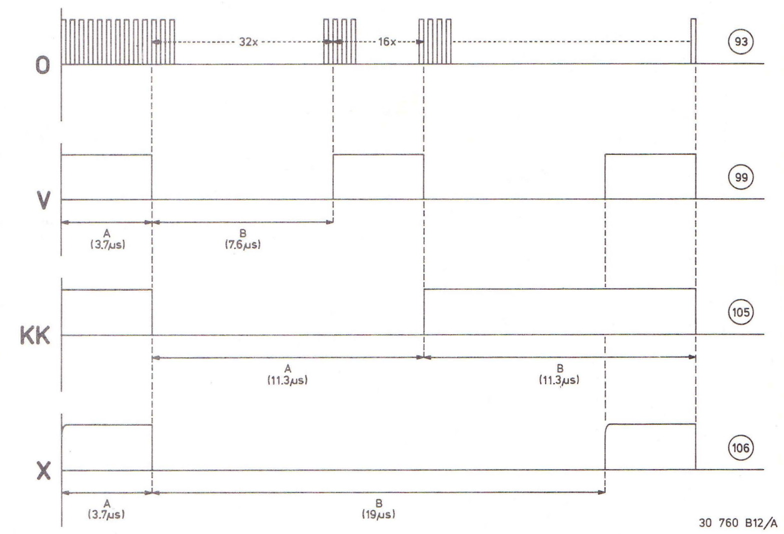
Nr.	See	Position	Amplitude	f	Time base	
71	A	stop/play	5,5 V	4,32 MHz		
72	B	play	5,5 V		DATA	
73	C*	stop/play	5,5 V	7,5/7,35 kHz	A= 66/68 µs	B= 66/68 µs
74	E	stop/play	5,5 V		A= 3,5 µs	B= 130,5 µs
75	F	stop	5,5 V		A= 3,5 µs	B= 130,5 µs
75	CC	play	5,5 V		A= 0,5 µs	B= 134 µs
76	B	play	5 V		DATA	
77	A	stop/play	5,5 V	8,64 MHz		
78	Z	stop/play	5,5 V	44,1 kHz	A= 11,3 µs	B= 11,3 µs
79	EE	stop/play	5,5 V		A= 3,7 µs	B= 7,6 µs
80	I	stop/play	5 V	7,35 kHz	A= 68 µs	B= 68 µs
81	FF	stop/play	5 V		A= 3,7 µs	B= 7,6 µs
82	B	play	5 V		DATA	
83	I	stop/play	5 V	7,5/7,35 kHz	A= 66/68 µs	B= 66/68 µs
84	II	stop/play	5 V		A= 10 µs	B= 124 µs
85	JJ	stop/play	5 V		A= 10 µs	B= 124 µs
86	M	stop/play	5 V	triggered with 80	A= 3 µs	B= 9,5 µs
87	A	stop/play	5 V	2,16 MHz		
88	OO	stop/play	5,5 V		A= 10 µs	B= 124 µs
89	J	stop/play	5 V	3,75/3,675 kHz	A= 133/136 µs	B= 133/136 µs
90	K	stop/play	5 V	3,675 kHz	A= 136 µs	B= 136 µs
91	L	play	5 V		A= 272 µs	
91	XX	see faultf. method	5-0 V		A= 272 µs	
92	N	stop/play	4 V	4,233 MHz		
93	O	stop/play	4 V	4,233 MHz		
94	P	stop/play	4 V	4,233 MHz		
95	T	stop/play	4 V	264,6 kHz		
96	Q	stop/play	4 V	2,116 MHz		
97	R	stop/play	4 V	1,058 MHz		
98	U	stop/play	4 V		A= 3,7 µs	B= 7,6 µs
99	V	stop/play	4 V		A= 3,7 µs	B= 7,6 µs
100	W	stop/play	4 V	44,1 kHz	A= 11,3 µs	B= 11,3 µs
101	X	stop/play	4 V		A= 3,7 µs	B= 19 µs
102	Y	stop/play	4 V		A= 1,8 µs	B= 20,7 µs
103	AA	stop/play	5 V		A= 22,6 µs	B= 22,6 µs
104	GG	stop/play	5 V		A= 3,7 µs	B= 7,6 µs
105	KK	stop/play	5 V		A= 11,3 µs	B= 11,3 µs
106	X	stop/play	5 V		A= 3,7 µs	B= 19 µs
107	HH	stop/play	5 V	Rep.f=176,4kHz	A= 0,3 µs	B= 5,4 µs
108	LL	stop/play	4 V	Rep.f=176,4kHz	A= 0,2 µs	B= 5,5 µs
109	TT	stop/play	5 V		A= 3,2 µs	B= 2,4 µs
110	UU	stop	5 V		A= 1,2 µs	B= 4,4 µs
110	VV	play	5 V		A= 3,2 µs	B= 2,4 µs
111	UU	stop	5 V		A= 1,2 µs	B= 4,4 µs
111		play	5 V		A= 3,2 µs	B= 2,4 µs
114	D	stop/play	0-5,5 V		A= 10 µs	B= 124 µs
115	G	stop	5,5-0 V			
116	MM	stop	0-5,5 V			
116	NN	play	5-0 V			

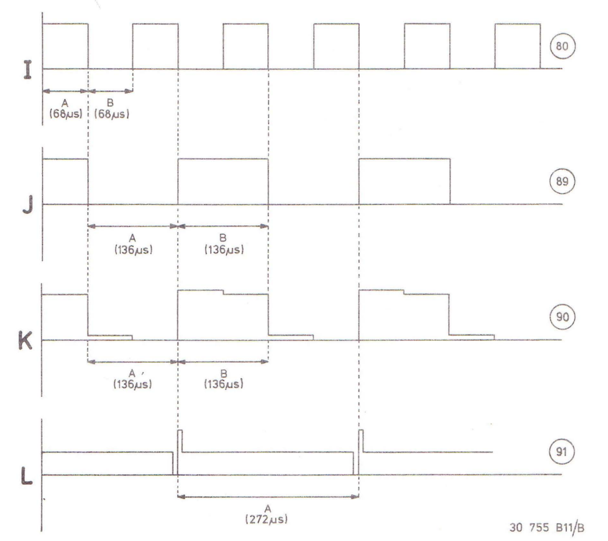
*In pos stop, signal is only present **after** the set was brought in play mode.

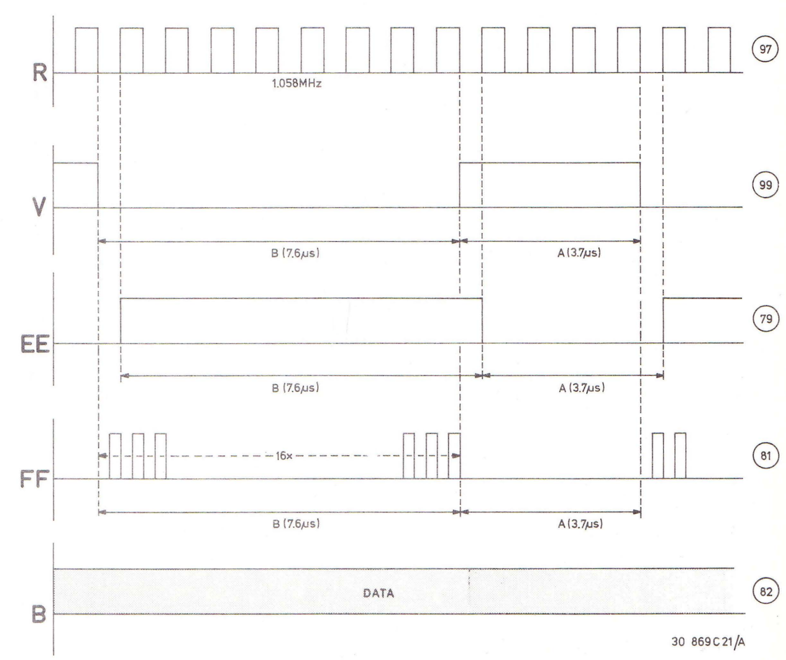




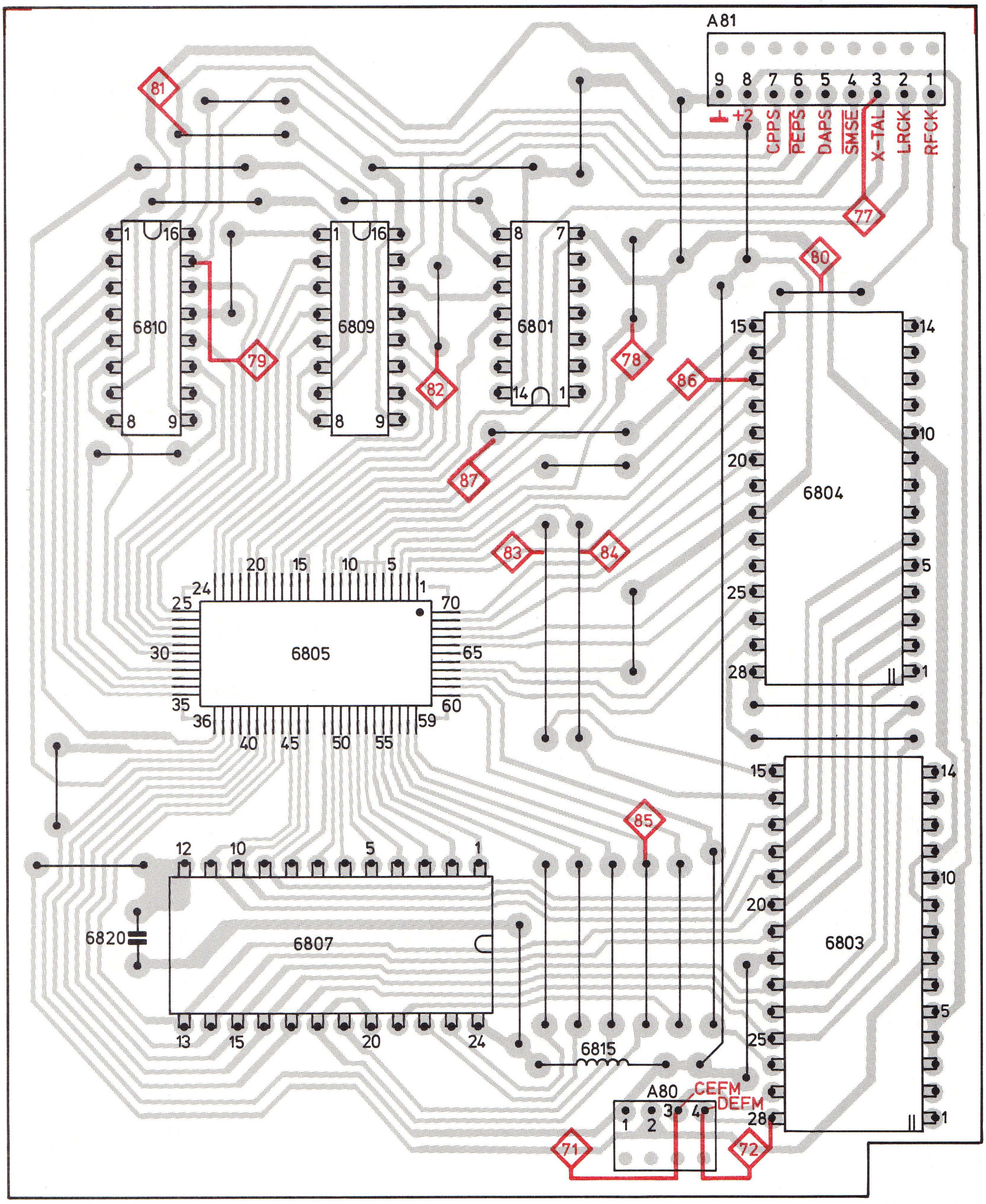






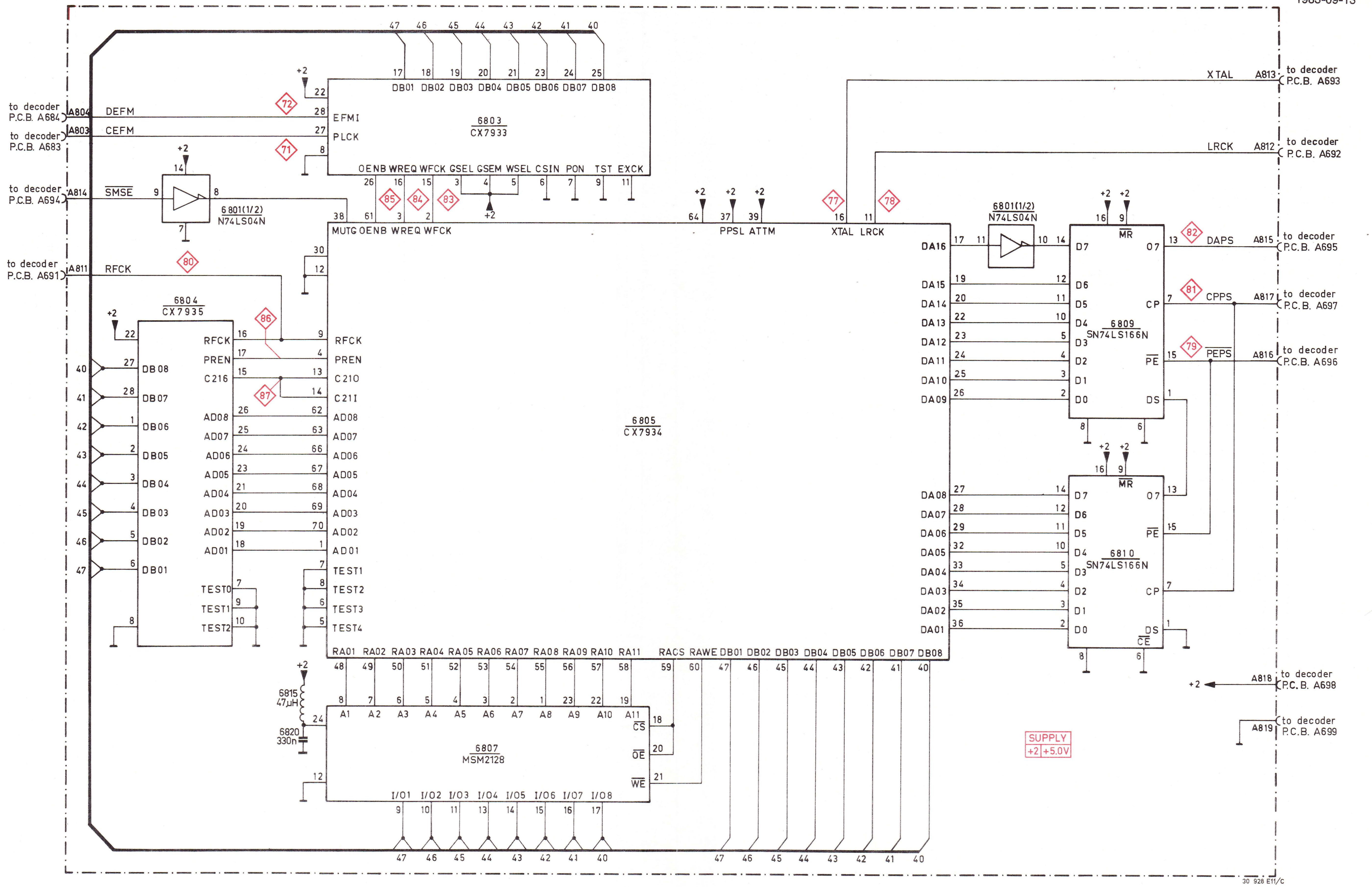


SUB. P.C.B.



32 854 C12

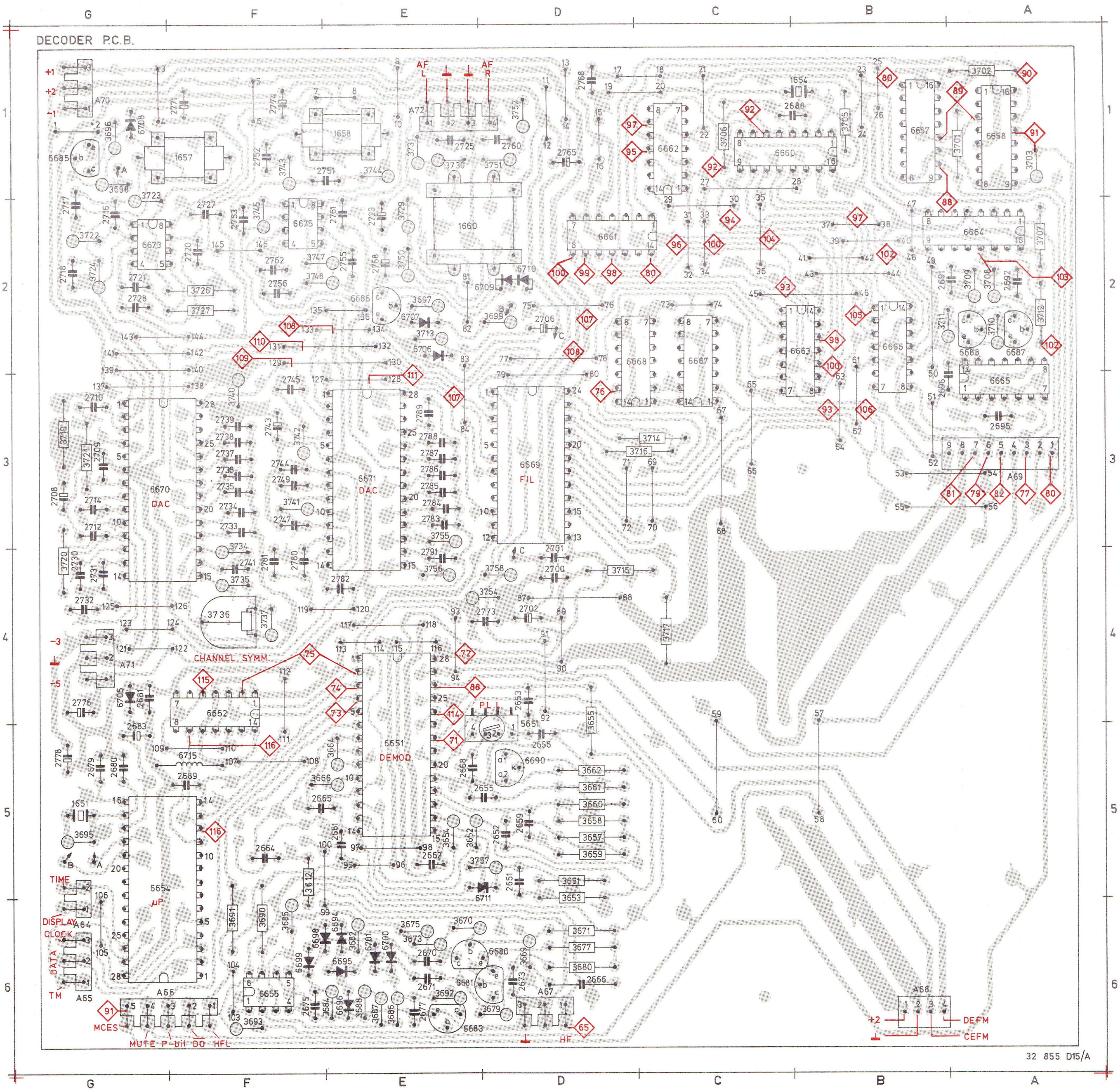
CIRCUIT DIAGRAM G (ERCO CONTROLLER)

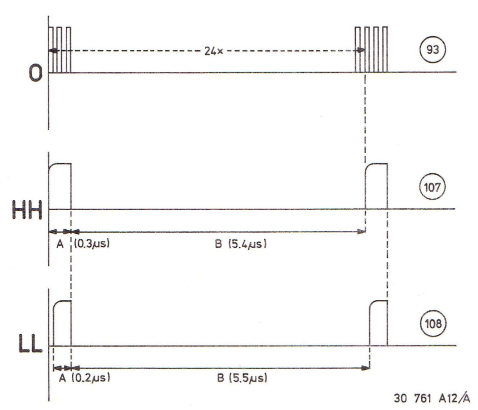


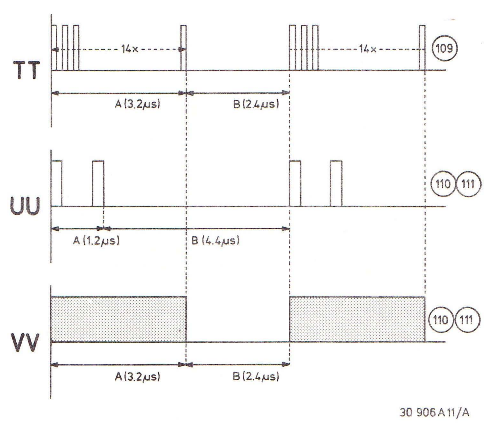
Decoding

Nr.	See	Position	Amplitude	f	Time base	
71	A	stop/play	5,5 V	4,32 MHz		
72	B	play	5,5 V		DATA	
73	C*	stop/play	5,5 V	7,5/7,35 kHz	A= 66/68 µs	B= 66/68 µs
74	E	stop/play	5,5 V		A= 3,5 µs	B= 130,5 µs
75	F	stop	5,5 V		A= 3,5 µs	B= 130,5 µs
75	CC	play	5,5 V		A= 0,5 µs	B= 134 µs
76	B	play	5 V		DATA	
77	A	stop/play	5,5 V	8,64 MHz		
78	Z	stop/play	5,5 V	44,1 kHz	A= 11,3 µs	B= 11,3 µs
79	EE	stop/play	5,5 V		A= 3,7 µs	B= 7,6 µs
80	I	stop/play	5 V	7,35 kHz	A= 68 µs	B= 68 µs
81	FF	stop/play	5 V		A= 3,7 µs	B= 7,6 µs
82	B	play	5 V		DATA	
83	I	stop/play	5 V	7,5/7,35 kHz	A= 66/68 µs	B= 66/68 µs
84	II	stop/play	5 V		A= 10 µs	B= 124 µs
85	JJ	stop/play	5 V		A= 10 µs	B= 124 µs
86	M	stop/play	5 V	triggered with 80	A= 3 µs	B= 9,5 µs
87	A	stop/play	5 V	2,16 MHz		
88	OO	stop/play	5,5 V		A= 10 µs	B= 124 µs
89	J	stop/play	5 V	3,75/3,675 kHz	A= 133/136 µs	B= 133/136 µs
90	K	stop/play	5 V	3,675 kHz	A= 136 µs	B= 136 µs
91	L	play	5 V		A= 272 µs	
91	XX	see faultf. method	5-0 V		A= 272 µs	
92	N	stop/play	4 V	4,233 MHz		
93	O	stop/play	4 V	4,233 MHz		
94	P	stop/play	4 V	4,233 MHz		
95	T	stop/play	4 V	264,6 kHz		
96	Q	stop/play	4 V	2,116 MHz		
97	R	stop/play	4 V	1,058 MHz		
98	U	stop/play	4 V		A= 3,7 µs	B= 7,6 µs
99	V	stop/play	4 V		A= 3,7 µs	B= 7,6 µs
100	W	stop/play	4 V	44,1 kHz	A= 11,3 µs	B= 11,3 µs
101	X	stop/play	4 V		A= 3,7 µs	B= 19 µs
102	Y	stop/play	4 V		A= 1,8 µs	B= 20,7 µs
103	AA	stop/play	5 V		A= 22,6 µs	B= 22,6 µs
104	GG	stop/play	5 V		A= 3,7 µs	B= 7,6 µs
105	KK	stop/play	5 V		A= 11,3 µs	B= 11,3 µs
106	X	stop/play	5 V		A= 3,7 µs	B= 19 µs
107	HH	stop/play	5 V	Rep.f=176,4kHz	A= 0,3 µs	B= 5,4 µs
108	LL	stop/play	4 V	Rep.f=176,4kHz	A= 0,2 µs	B= 5,5 µs
109	TT	stop/play	5 V		A= 3,2 µs	B= 2,4 µs
110	UU	stop	5 V		A= 1,2 µs	B= 4,4 µs
110	VV	play	5 V		A= 3,2 µs	B= 2,4 µs
111	UU	stop	5 V		A= 1,2 µs	B= 4,4 µs
111		play	5 V		A= 3,2 µs	B= 2,4 µs
114	D	stop/play	0-5,5 V		A= 10 µs	B= 124 µs
115	G	stop	5,5-0 V			
116	MM	stop	0-5,5 V			
116	NN	play	5-0 V			

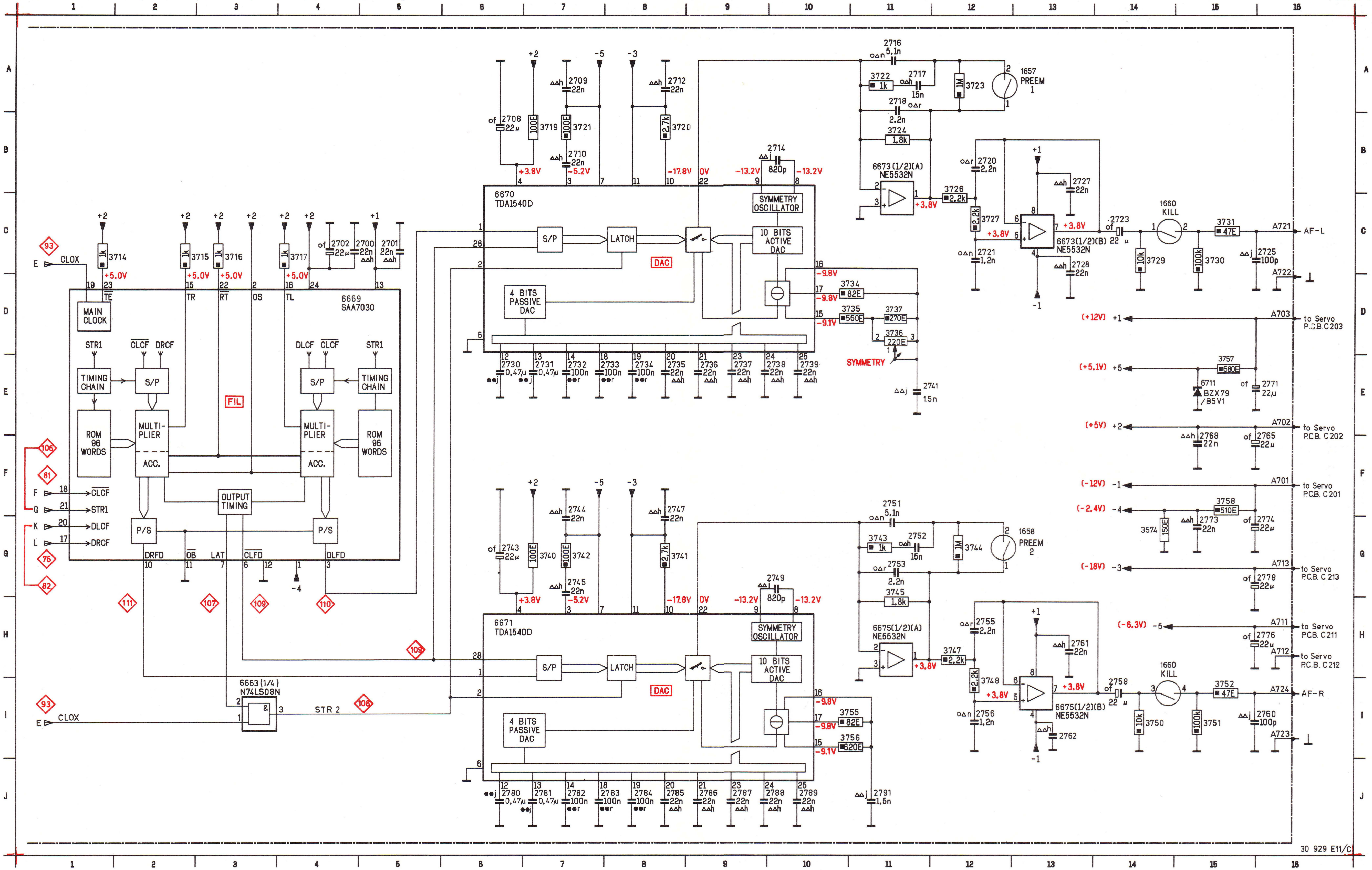
*In pos stop, signal is only present **after** the set was brought in play mode.


DECODER P.C.B.
CHANNEL SYMM.
DAC
DEMOD.
FIL
MUTE P-bit DO HFL
MCES
TIME
DISPLAY
CLOCK
DATA
TM
DEFM
CEFM
AF L
AF R
HF
32 855 D15/A


O
HH
LL
24×
A (0,3μs)
B (5,4μs)
A (0,2μs)
B (5,5μs)
30 761 A12/A


TT
UU
VV
14×
A (3,2μs)
B (2,4μs)
A (1,2μs)
B (4,4μs)
30 906 A11/A

CIRCUIT DIAGRAM H (DECODING PART, FIL, DAC's AND SUPPLY)



11. CHANGES

Introduced with A83-108 d.d. 1983-02-21 from marking AH00301.

Description		Reason
Frontpage		CD200/05 added
Table of contents	1-1-b	Contents adapted
Table of contents	1-2	Added Table of contents
Technical specification	3-1-a	Specification adapted
Servicing hints	5-1-a	Text adapted
Parts list service aids	5-2-a	Code numbers adapted
Servicing hints	5-4-a	Text "Servicing the RAFOC unit" changed
Measurements and adjustments	6-1-a	Text adapted
Measurements and adjustments	6-2-a	Text adapted
Electrical measurements and adjustments	6-3-a	Text "Laser power supply" adapted
Electrical measurements and adjustments	6-4-a	Text "Adjusting the focus bandwidth" adapted
Exploded view C.D.M.	7-2-1	Drawing + partslists adapted
Exploded view cabinet	7-2-2	Exploded view adapted Added: Lamps LA1 + LA2 Screws Cooling block supply PCB changed
Power supply	8-3-1	Lamps (LA1, LA2) added Diodes (6474, 6475) added Standard symbols added
Power supply PCB	8-3-2	Drawing and parts list added
Pre-amp. + laser circuit (NEG.VOLT.PH.)	8-5-1	Circuit diagram adapted to production level
Pre-amp. + laser PCB (NEG.VOLT.PH.)	8-5-2	Drawings and parts list adapted to production level
Pre-amp. + laser circuit (POS.VOLT.SH.)	8-5-3	Circuit diagram adapted for lightpin with positive supply voltage
Pre-amp. + laser PCB (POS.VOLT.SH.)	8-5-4	Drawings and parts list adapted
Circuit diagram servo part 1	8-11-1	Drawing adapted to production level
Servo PCB	8-11-2	Drawing adapted to production level
Servo PCB	8-11-3	Drawing adapted to production level
Circuit diagram servo part 2	8-11-4	Drawing adapted to production level
Circuit diagram decoding part 1	8-15-1	Drawing adapted to production level
Decoding PCB	8-15-2	Drawing adapted to production level
Decoding PCB	8-15-3	Drawing adapted to production level
Circuit diagram decoding part 2	8-15-4	Drawing adapted to production level
Circuit diagram decoding part 3	8-16-a	Drawing adapted
Decoding PCB	8-17-a	Drawing + parts list adapted
Drawing of wiring	9-1-1	Wiring adapted to production level

Introduced with A83-125 d.d. 1983-04-28

Description		Reason
Table of contents	1-1-c	Adapted
Table of contents	1-2-a	Adapted
Parts list service aids	5-2-b	Lasersimulator POS.VOLT.SH. added
Measurements and adjustments	6-5	Measurement POS.VOLT.SH. added

Introduced with A83-136 d.d. 1983-09-13

Description		Reason
Faultfinding method	10-1-a÷10-15-a	Changed faultfinding method.